Single Aisle
TECHNICAL TRAINING MANUAL
GENERAL FAMILIARIZATION COURSE - T4 (IAE V2500)
POWER PLANT LEVEL 1

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POWER PLANT LEVEL 1

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UGB13131 - U2AT4M0

28 FUEL SYSTEM PRESENTATION (1)

SYSTEM INTRODUCTION

The A318, A319, and A320 share a common fuel system design.
The fuel tanks are integrated into the center fuselage area and the wings. The center tank is part of the center wing box. The wing tanks are divided into inner and outer cells. To reduce the structural load on the wings, the fuel in the outer cells is not used until the fuel load in the inner cells decreases to a low level.
Two fuel pumps are installed in the center tank, two fuel pumps are installed in each wing tank inner cell and one fuel pump is installed for the APU. Fuel is supplied to the engines from the center tank first. After the center tank is empty, fuel is supplied from the wing inner cells.
There is no direct supply from the outer cells to the engines. Two intercell transfer valves in each wing let the fuel transfer from the outer cells to the inner cells when the low level is reached.
Two engine Low Pressure (LP) valves are installed to supply or cut off fuel to the engines. The LP valve is closed when the related engine is shut down or when the engine fire pushbutton is released.
A crossfeed valve is installed to connect or isolate the left and right hand sides. It enables engine to be fed from any available fuel pump. On the ground, the crossfeed valve enables fuel to be transferred from tank to tank. The valve is closed for normal operation.
The fuel system also feeds the APU directly from the left hand side. The APU LP valve is installed to supply or cut off fuel to the APU. It closes when the APU is shut down or when the APU FIRE pushbutton is released out.

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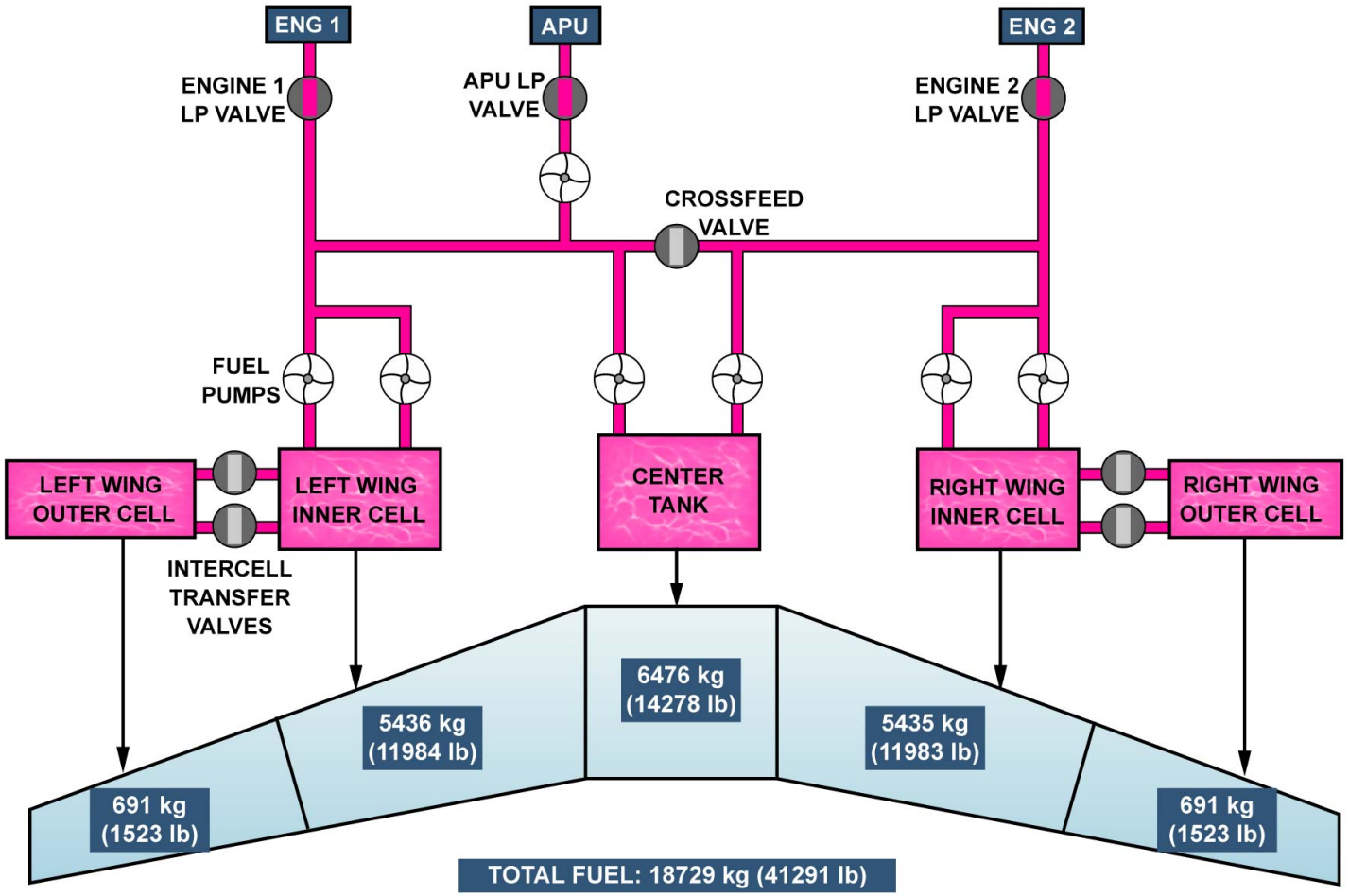

SYSTEM INTRODUCTION

28 FUEL SYSTEM PRESENTATION (1)

SYSTEM INTRODUCTION (continued)

A321

The A321 fuel tanks are integrated into the center fuselage area and the wings. Like the A318/A319/A320, the center tank is part of the center wing box but unlike the A318/A319/A320, the wing tanks are not divided. The tanks are simply called left and right wing tanks.
Two fuel pumps are installed in each wing tank. One fuel pump is installed for the APU. Fuel is supplied to the engines from the wing tanks only. As the fuel level in the wing decreases, the center tank fuel is transferred to the wing tanks until the center tank is empty.
Fuel transfer from the center tank to the wing tanks is controlled by transfer valves. When the transfer valves are opened, they supply pressure to two jet pumps in the center tank and transfer the fuel from the center tank to the wings.
Two engine LP valves are installed to supply or cut off fuel to the engines. The LP valve is closed when the related engine is shut down or when the engine fire pushbutton is released.
A crossfeed valve is installed to connect or isolate the left and right hand sides. It enables engine to be fed from any available fuel pump. On the ground, the crossfeed valve enables fuel to be transferred from tank to tank. The valve is closed for normal operation.
The fuel system also feeds the APU directly from the left hand side. The APU LP valve is installed to supply or cut off fuel to the APU. It closes when the APU is shut down or when the APU FIRE pushbutton is released out.

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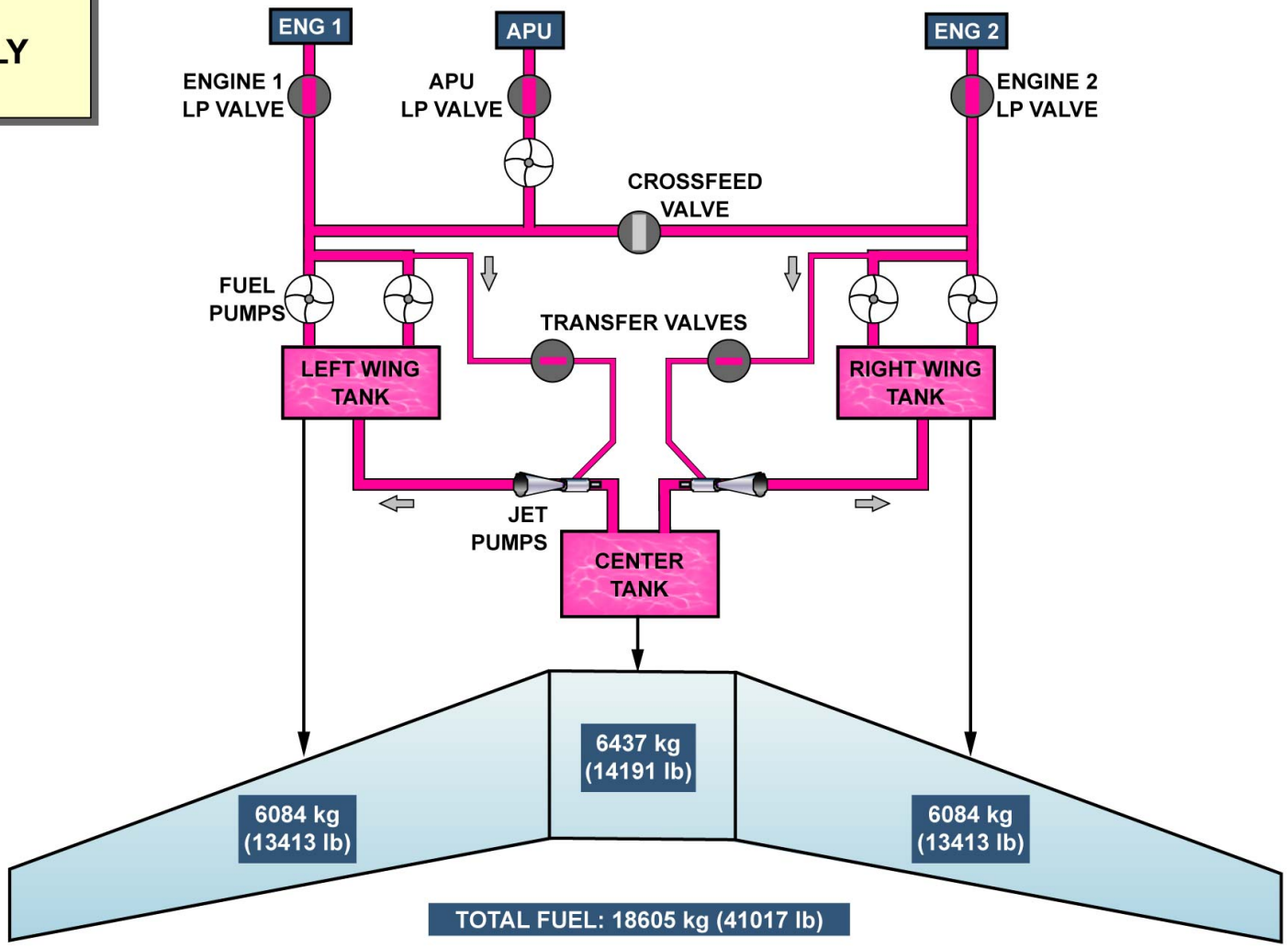
A321 ONLY



SYSTEM INTRODUCTION - A321

28 FUEL SYSTEM PRESENTATION (1)

CONTROL AND INDICATING

This section will highlight the control panels and indications for the fuel system.

CONTROL PANELS

The FUEL control panel is operated from the overhead panel.
The A321 FUEL control panel is very similar to the A318/A319/A320, except:
- The fuel transfer link between the center and wing tanks is indicated,
- CTR TK XFR is indicated instead of CTR TK PUMPS.

The wing tank pumps are controlled manually but the center tank pumps are normally controlled automatically. On the A318/A319/A320 fuel control panel, the MODE SEL P/BSW enables the pilot to select automatic or manual mode for the center tank pumps.
The MODE SEL P/BSW on the A321 FUEL control panel enables the pilot to select manual or automatic mode for the CTR TK XFR valves.

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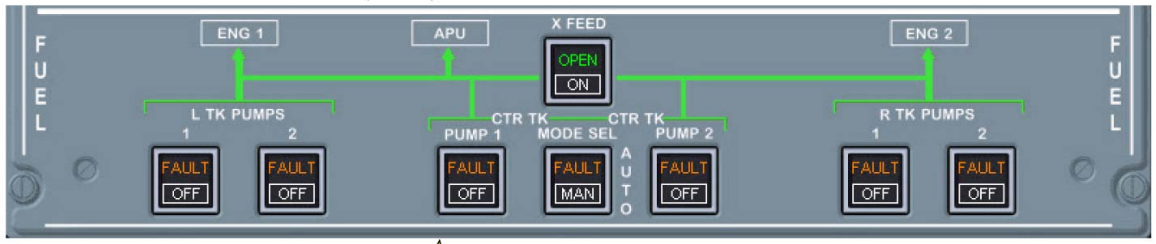
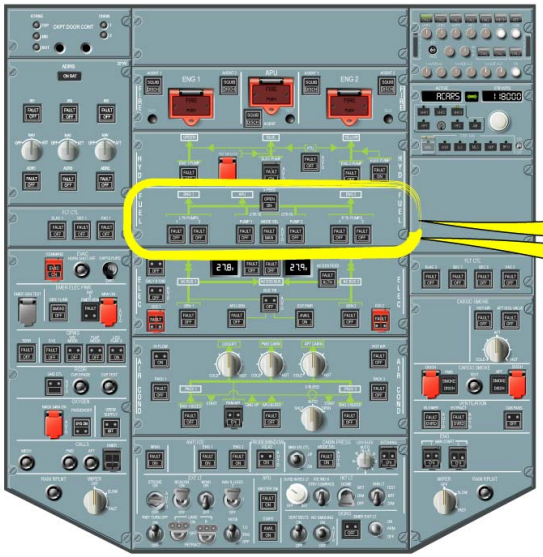
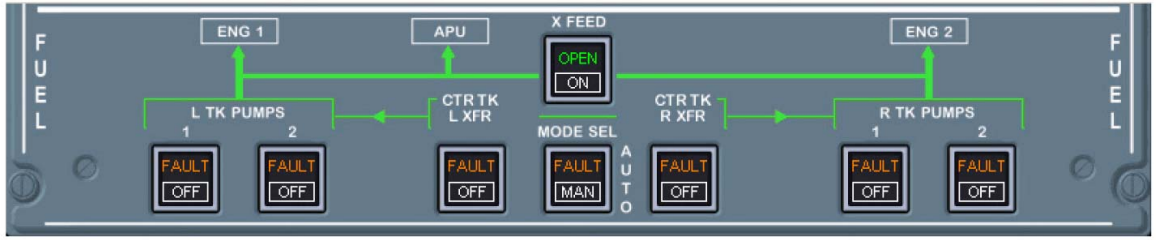
A318/A319/A320 FUEL PANEL (40VU)



OVERHEAD PANEL



A321 FUEL PANEL (40VU)



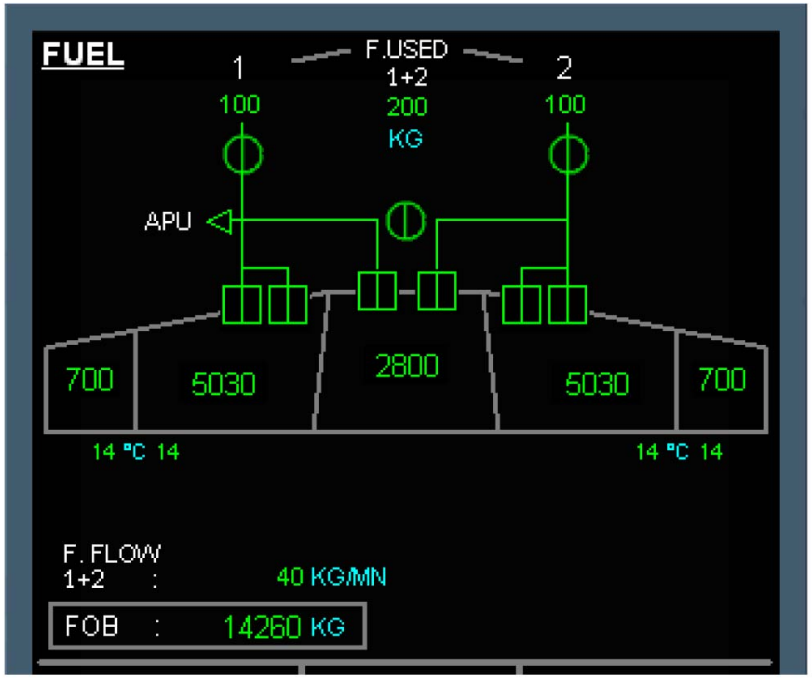
CONTROL AND INDICATING - CONTROL PANELS

28 FUEL SYSTEM PRESENTATION (1)

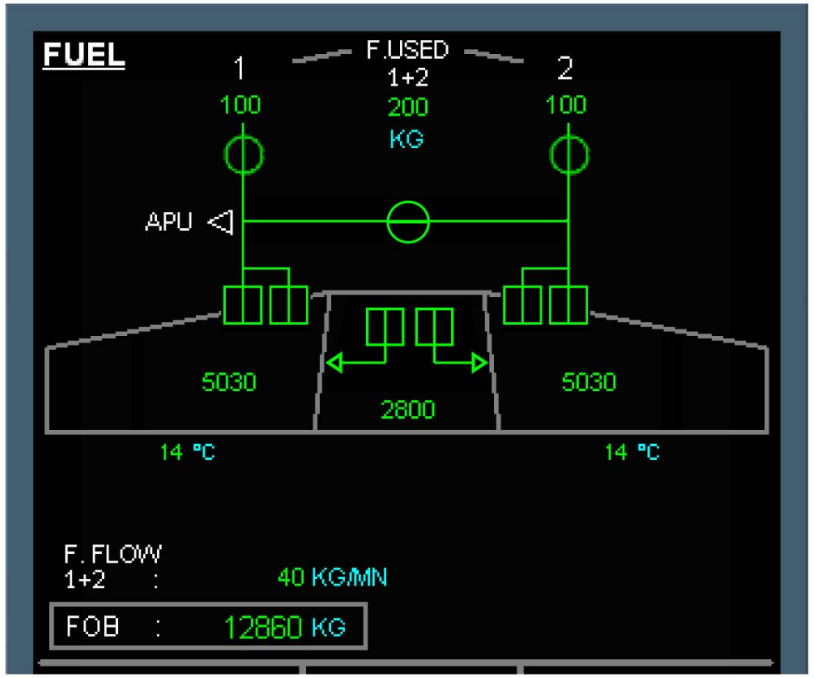
CONTROL AND INDICATING (continued)

ECAM FUEL PAGE

The configuration of the fuel system valves and pumps as well as quantity indications are displayed on the ECAM FUEL system page.
The total Fuel On Board (FOB) indication is duplicated on the Engine/Warning Display.
Let's briefly review all the A321 differences using the ECAM FUEL page:
- There is no inner and outer cells in the wing tanks,
- Fuel is transferred from the center tank to the wing tanks via two jet pumps and transfer valves,
- Fuel is always fed to the engines from the wing and not from the center tank.



A318/A319/A320 FUEL PAGE



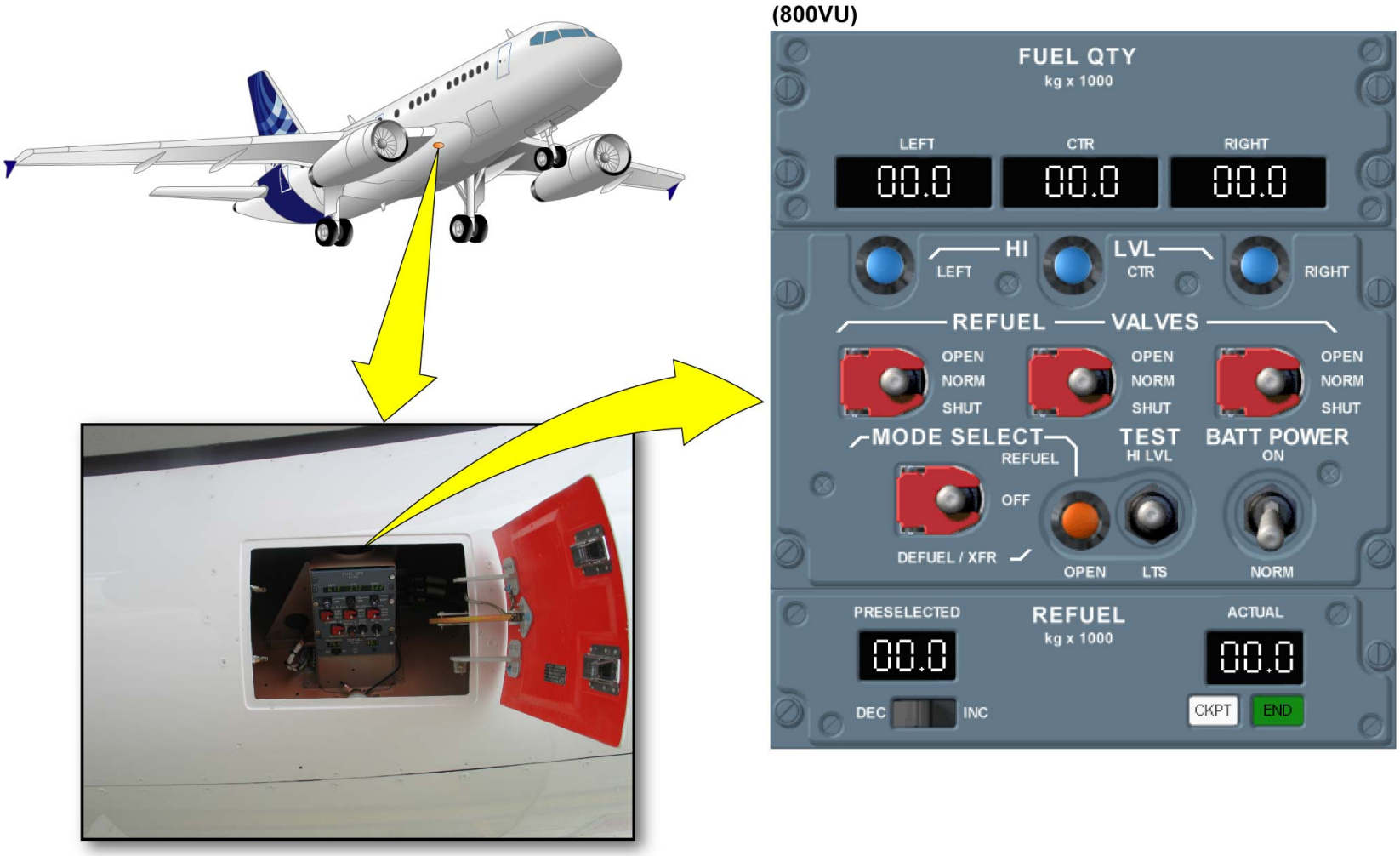
A321 FUEL PAGE

CONTROL AND INDICATING - ECAM FUEL PAGE

28 FUEL SYSTEM PRESENTATION (1)

REFUEL/DEFUEL PANEL

The Refuel/Defuel panel functions are:
- Automatic or manual refueling,
- High level test,
- Defueling,
- Fuel transfer,
- Refueling on batteries.



REFUEL/DEFUEL PANEL

28 FUEL SYSTEM PRESENTATION (1)

REFUEL/DEFUEL COUPLING AND REFUEL VALVE

The Refuel/Defuel coupling is below the RH wing leading edge.
The Refuel/Defuel coupling shown is the optional one on the LH side.
There is one refuel valve per tank. Each of the three refuel valves has a manual plunger. When pressed, the plunger holds the valve open in case of a valve electrical failure during refueling.

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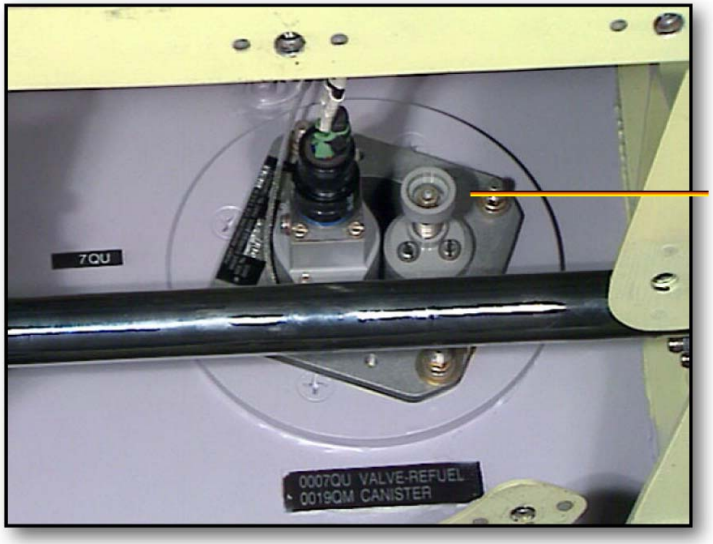
REFUEL DEFUEL COUPLING

EACH REFUEL VALVE IS EQUIPPED WITH A MANUAL PLUNGER TO OPERATE THE VALVE IN CASE OF ELECTRICAL FAILURE



REFUEL/DEFUEL COUPLING AND REFUEL VALVE

28 FUEL SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The 2-channel Fuel Quantity Indication Computer (FQIC) calculates the fuel mass, controls automatic refueling and monitors the system with different interfaces.
The Fuel Level Sensing Control Units (FLSCUs) send fuel level signals to the FQIC and to different aircraft circuits and systems.
They are installed in the avionics compartment.
The BITE test of the FQIC does a check of the Fuel Quantity Indicating System and the Fuel Level Sensing System (FLSS). The FLSCUs do not interface directly with the Centralized Fault Display System (CFDS).

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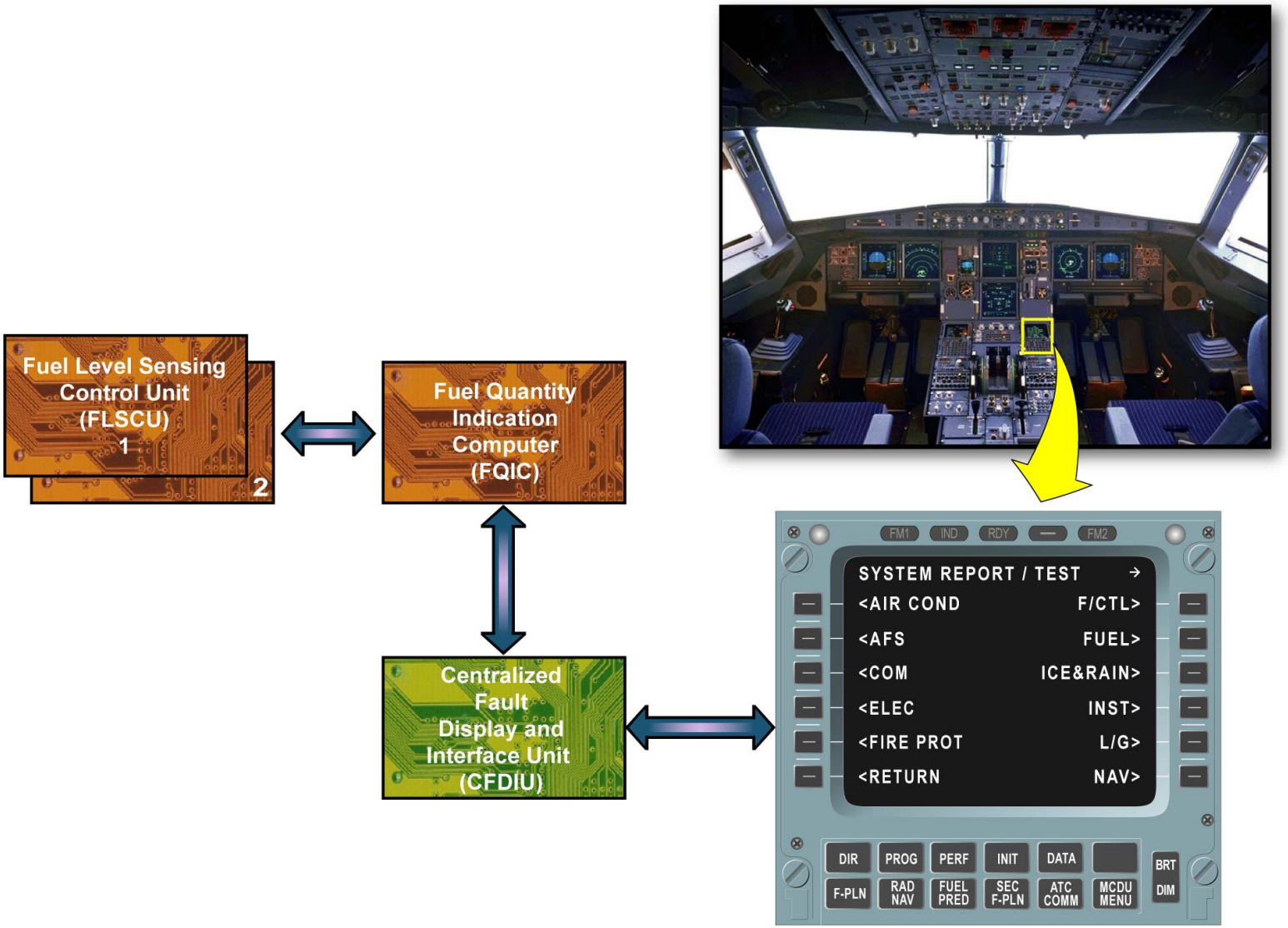

MAINTENANCE/TEST FACILITIES

28 FUEL SYSTEM PRESENTATION (1)

OPTIONS

There are some options for the fuel system which can be selected by operators.
The Refuel/Defuel panel can also be installed at the wing leading edge.
A cockpit Refuel panel can be installed. It will always take priority over the external Refuel/Defuel panel.
Auxiliary fuel tanks can be installed in the aircraft. These Additional Center Tanks (ACTs) are installed in the cargo compartments and extend the range of the aircraft.

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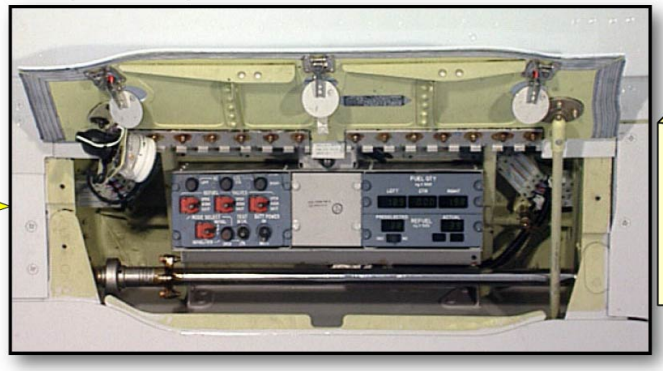
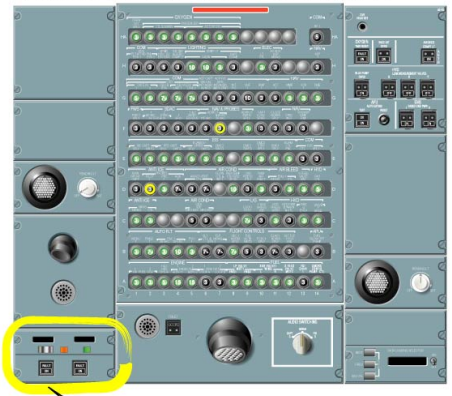
REFUEL/DEFUEL PANEL

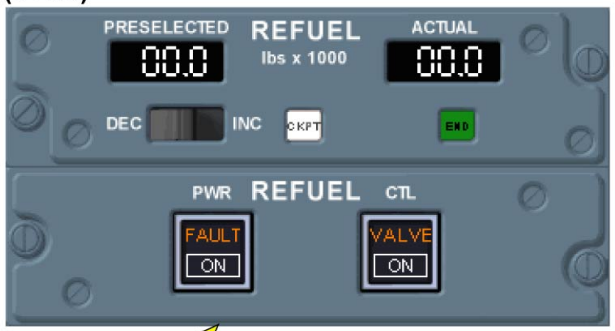


AS AN OPTION,
THE REFUEL/DEFUEL PANEL
LOCATION CAN BE CHANGED
TO THE WING LEADING EDGE

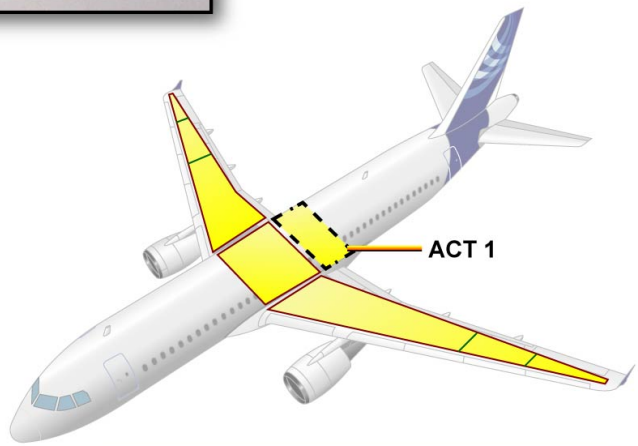
COCKPIT OVERHEAD PANEL



(51VU)



AS AN OPTION,
A COCKPIT REFUELING PANEL
CAN BE INSTALLED



AS AN OPTION, ONE OR TWO
AUXILIARY FUEL TANKS
CAN BE INSTALLED IN THE AIRCRAFT
(A319-100, A320-200 AND A321-200).

THESE ADDITIONAL CENTER TANKS (ACTs)
ARE INSTALLED IN THE CARGO
COMPARTMENTS AND EXTEND
THE RANGE OF THE AIRCRAFT

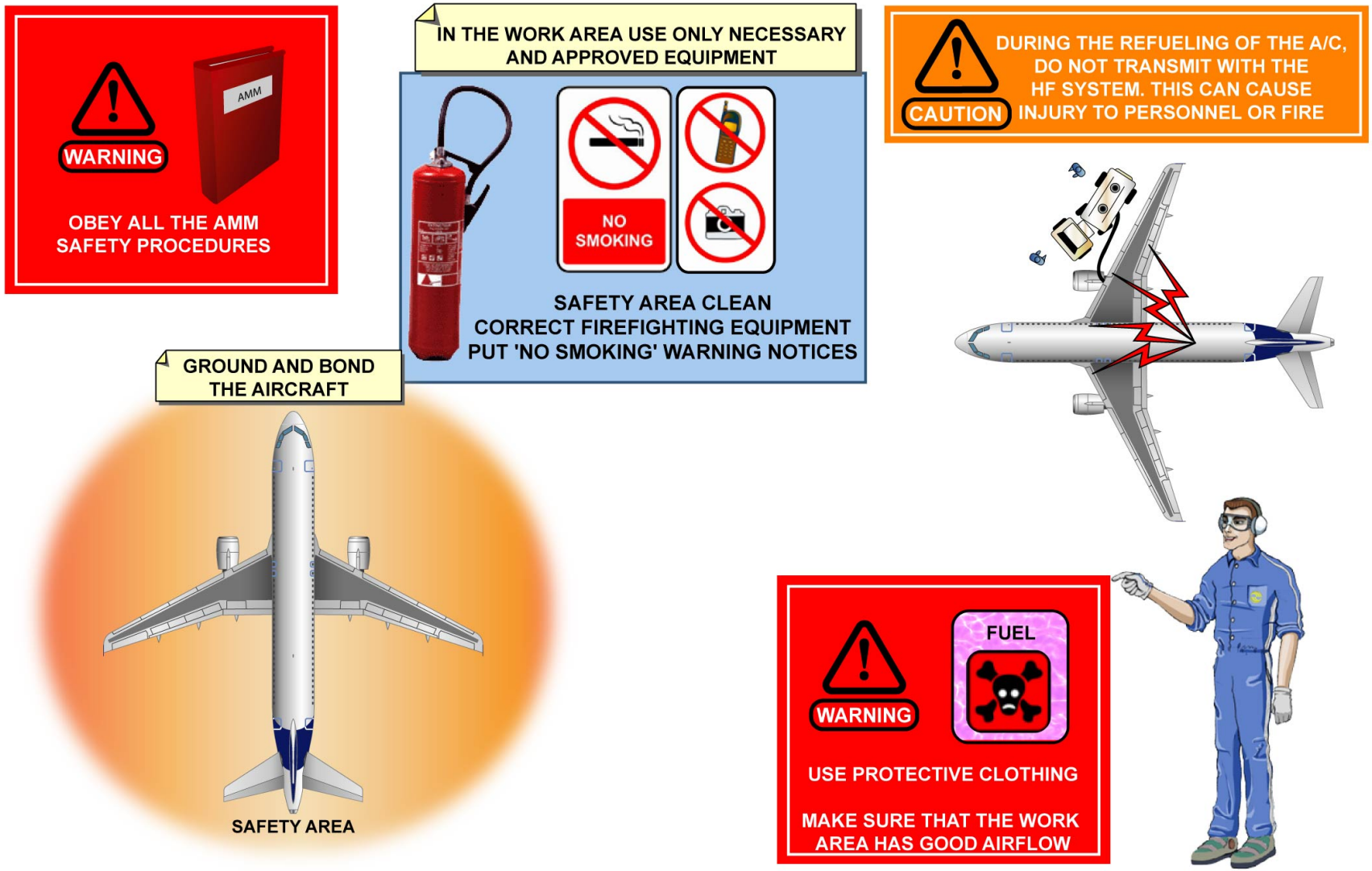
OPTIONS

28 FUEL SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you do work on the aircraft, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures. This will prevent injury to persons and/or damage to the aircraft. Here is an overview of the main safety precautions related to the fuel system.
Aircraft fuel is poisonous. Do not get aircraft fuel in your eyes, mouth, nose, ears or on your skin.
Use solvents, cleaning agents, sealants or other special materials only with good airflow in the work area. Use protective clothing to prevent personal contamination and formation of static electricity.
Make sure that correct firefighting equipment is available.
Make sure that the safety area is clear and clean. Obey the safety precautions in the safety area.
Put "NO SMOKING" warning notices around the work area.
Ground and bond the aircraft.
In the work area:
- Do not use flames without protection and do not use any material or tools which can cause sparks,
- Use only approved electrical / electronic equipment,
- Make sure that the work area has sufficient airflow to do the work safely. If not, use a respirator,
- Do not pull or move metal objects on the ground,
- Immediately flush away or remove fuel leakage.

During refueling, do not transmit with the HF system. This can cause fire or injury to personnel.


WARNING
AMM
OBEY ALL THE AMM SAFETY PROCEDURES
IN THE WORK AREA USE ONLY NECESSARY AND APPROVED EQUIPMENT
NO SMOKING
SAFETY AREA CLEAN
CORRECT FIREFIGHTING EQUIPMENT
PUT 'NO SMOKING' WARNING NOTICES
CAUTION
DURING THE REFUELING OF THE A/C, DO NOT TRANSMIT WITH THE HF SYSTEM. THIS CAN CAUSE INJURY TO PERSONNEL OR FIRE
GROUND AND BOND THE AIRCRAFT
SAFETY AREA
WARNING
FUEL
USE PROTECTIVE CLOTHING
MAKE SURE THAT THE WORK AREA HAS GOOD AIRFLOW

SAFETY PRECAUTIONS

28 FUEL SYSTEM PRESENTATION (1)

FUEL TANK SAFETY

After three fuel tank explosions in recent decades, which caused in 346 fatalities, the U.S Department of Transportation, Federal Aviation Administration (FAA), introduced new regulations to improve fuel tank safety.
These regulations are related to the prevention of ignition sources in fuel tanks of current type certificated aircraft. To obey these regulations, a one-time fuel system safety and design review must be done.

CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)

The FAA issued Special Federal Aviation Regulation (SFAR) 88, which gives a detailed description of the CDCCL concept.
The EASA requested the SFAR 88 (TGL 47) to be added to PART 145, PART M and PART 147 to reinforce the application of these regulations.
This includes:
- A conception part intended to aircraft design features,
- A maintenance part.

A CDCCL is a limitation requirement to preserve a critical ignition source prevention feature of the fuel system design that is necessary to prevent the occurrence of an unsafe condition.
The function of the CDCCL is to give instructions to prevent critical ignition source feature from alterations, repairs or maintenance actions during configuration change.
The aircraft manufacturers must supply a document to their customers to give the list of all the maintenance tasks impacted by the CDCCL.
For AIRBUS this document is called the Fuel Airworthiness Limitations and it is added to the Airworthiness Limitation Section part 5.
The CDCCL items are listed in the Airworthiness Limitations Form.

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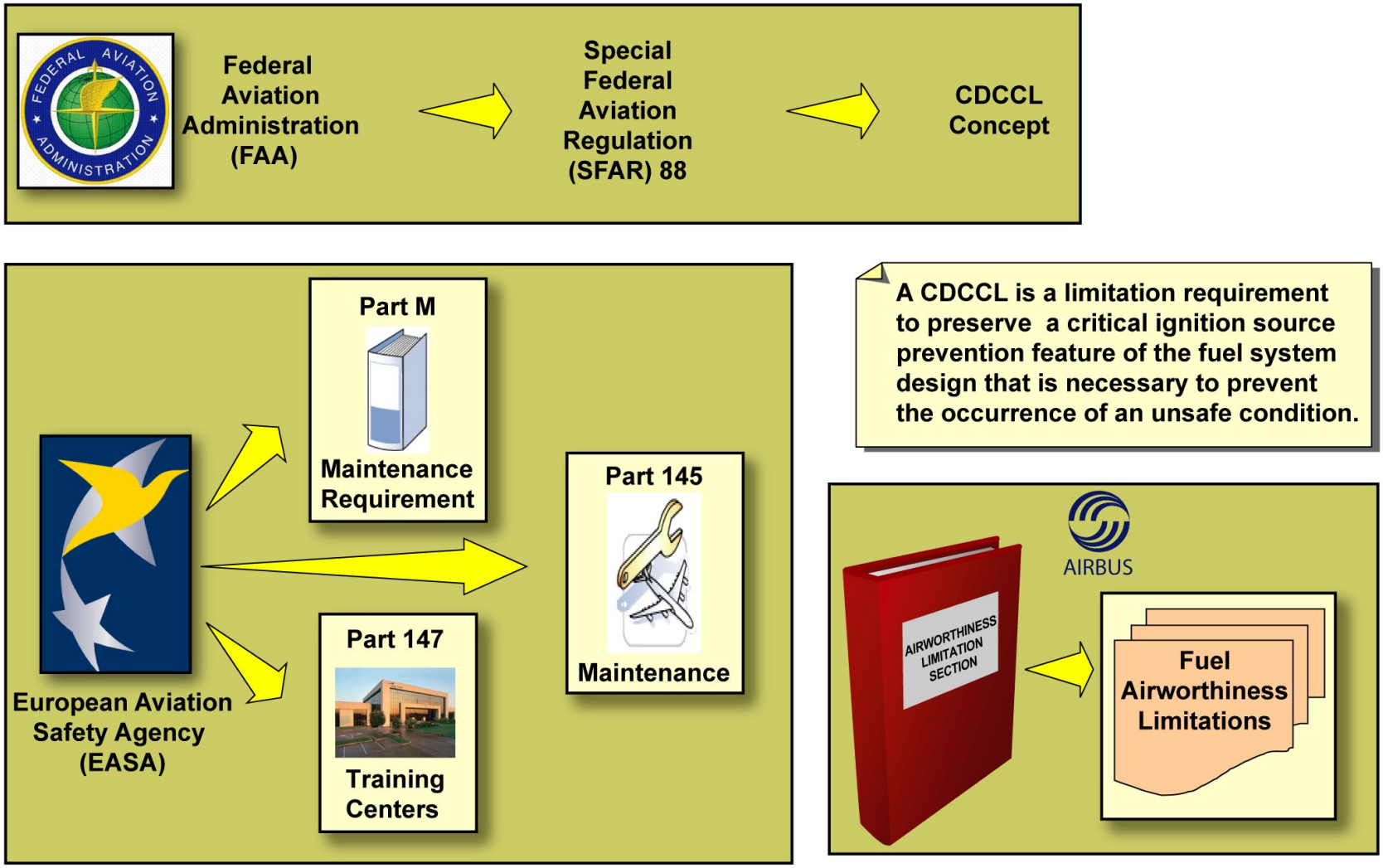
CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)


Federal Aviation Administration (FAA)
Special Federal Aviation Regulation (SFAR) 88
CDCCL Concept
Part M
Maintenance Requirement
Part 145
Maintenance
Part 147
Training Centers
European Aviation Safety Agency (EASA)
A CDCCL is a limitation requirement to preserve a critical ignition source prevention feature of the fuel system design that is necessary to prevent the occurrence of an unsafe condition.
AIRBUS
AIRWORTHINESS LIMITATION SECTION
Fuel Airworthiness Limitations

FUEL TANK SAFETY - CRITICAL DESIGN CONFIGURATION CONTROL LIMITATIONS (CDCCL)

28 FUEL SYSTEM PRESENTATION (1)

FUEL TANK SAFETY (continued)

FUEL SYSTEM DESIGN CONFIGURATION

The Airbus aircraft fuel systems have, by design, a number of features that are intended to protect the system from inadvertent ignition.

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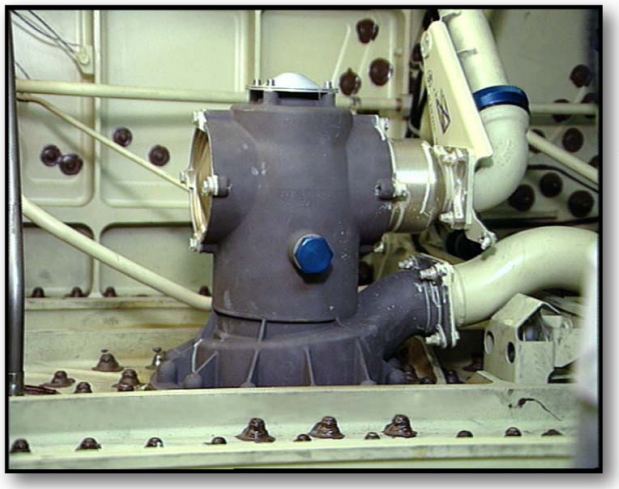
EXAMPLES OF AIRBUS FUEL SYSTEM DESIGN

Electrical harnesses in the tanks use very low voltage current (less than 5 VDC) and are far enough for the surrounding equipment and structure (segregated routing).

Fuel pumps are the only electrical equipment using high power current (115 VAC). Consequently, pumps harnesses are located under the lower wing skin panels outside the fuel tanks.



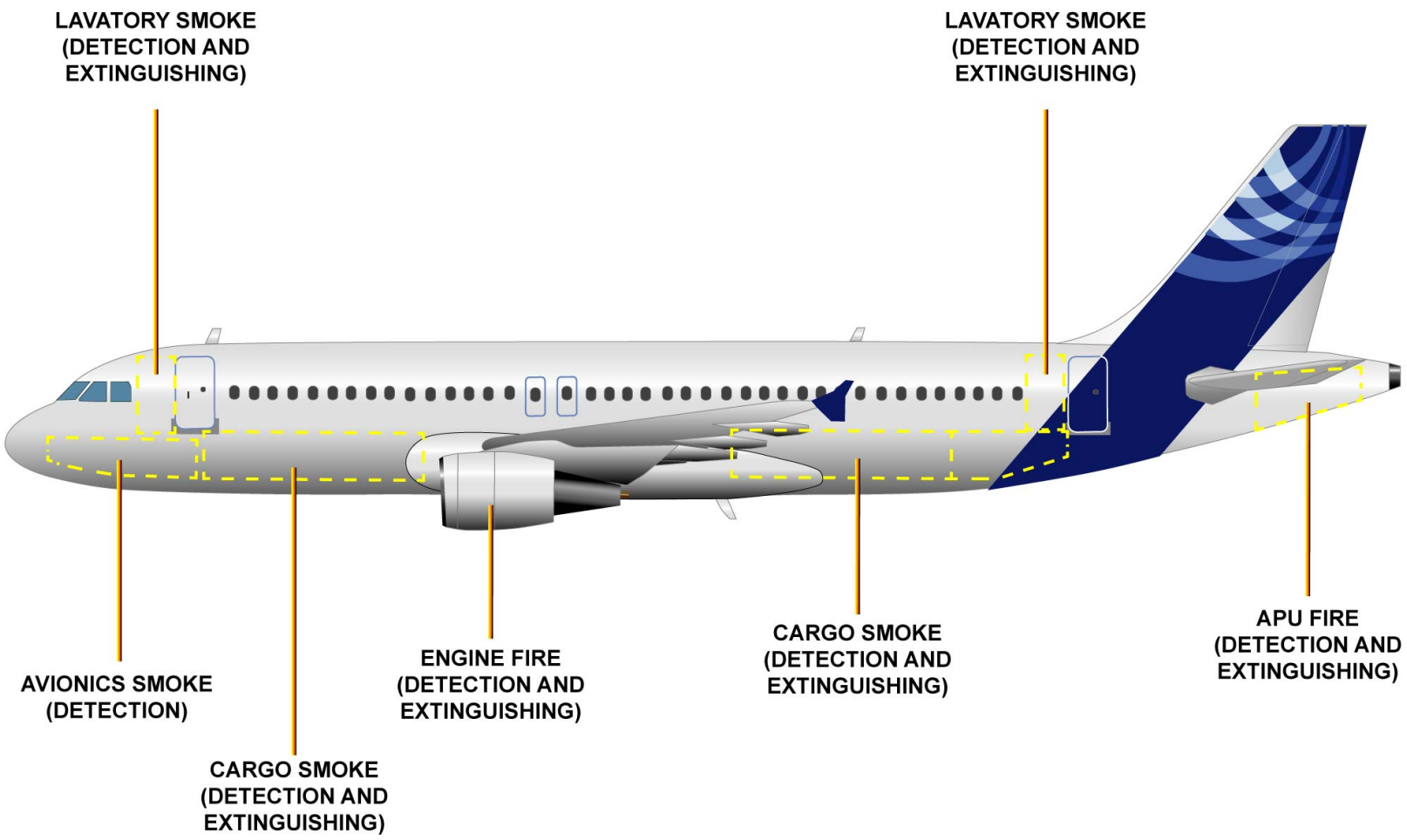
Fuel pumps are installed in a self-contained explosive canister.

FUEL TANK SAFETY - FUEL SYSTEM DESIGN CONFIGURATION

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

GENERAL

The A320 family fire protection systems have:
- Fire detection and extinguishing systems for the engines and APU,
- Smoke detection for the avionics equipment and compartment,
- Smoke detection and fire extinguishing for the cargo compartments and lavatories,
- Portable fire extinguishers for the flight compartment and the cabin.


LAVATORY SMOKE
(DETECTION AND
EXTINGUISHING)
LAVATORY SMOKE
(DETECTION AND
EXTINGUISHING)
AVIONICS SMOKE
(DETECTION)
CARGO SMOKE
(DETECTION AND
EXTINGUISHING)
ENGINE FIRE
(DETECTION AND
EXTINGUISHING)
CARGO SMOKE
(DETECTION AND
EXTINGUISHING)
APU FIRE
(DETECTION AND
EXTINGUISHING)

GENERAL

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

ENGINE FIRE PROTECTION

The engine fire protection is done by two sub-systems: the FIRE detection system and the FIRE extinguishing system.

DETECTION AND EXTINGUISHING

The engines have individual fire detection systems.
Each system has two identical detection loops (A and B) installed in parallel. Each loop is has 3 detector elements.
The two loops are monitored by a Fire Detection Unit (FDU). FDU 1 monitors the loops on engine 1 and FDU 2 monitors the loops on engine 2.
The FDU sends FIRE and FAULT signals to the Flight Warning Computer (FWC) for display on the ECAM.
The guarded FIRE P/B switches give FIRE indication and are used to isolate the affected systems. When the FIRE P/B is released out, fuel supply, hydraulic supply, electrical power and bleed supply are cut off. This also arms the extinguishing system.
To extinguish the fire, each engine has 2 fire bottles installed in its related pylon.
Each bottle is discharged by a related AGENT P/B switch. The P/B switches are on the overhead FIRE panel.
The TEST buttons are used to do a test the related fire detection and extinguishing system operation.

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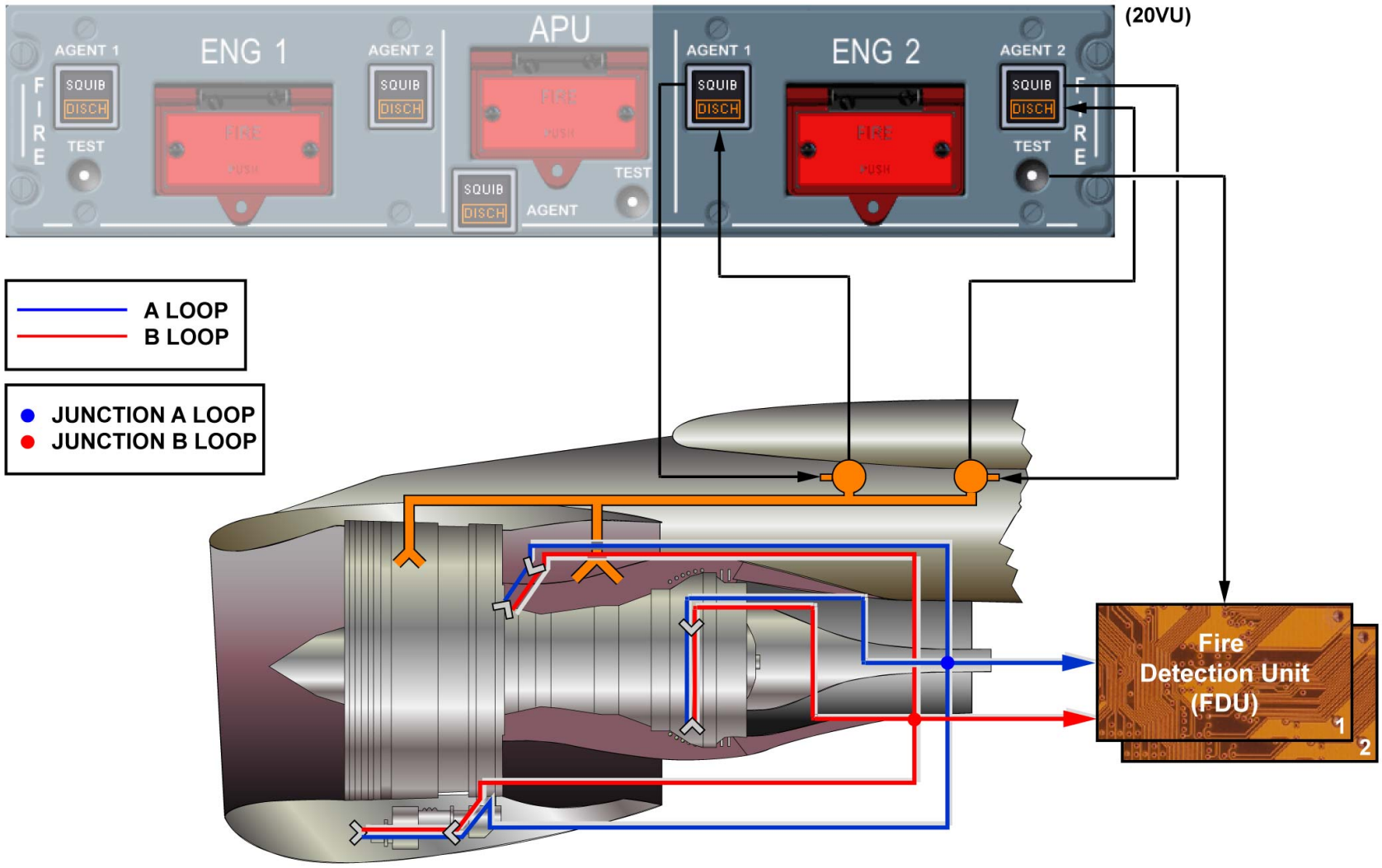

ENGINE FIRE PROTECTION - DETECTION AND EXTINGUISHING

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

ENGINE FIRE PROTECTION (continued)

CONTROL AND INDICATING

The overhead FIRE panel handles both detection and extinguishing functions. In addition to the indications on the FIRE panel, the ENG panel is equipped with a red FIRE indicator light for each engine.

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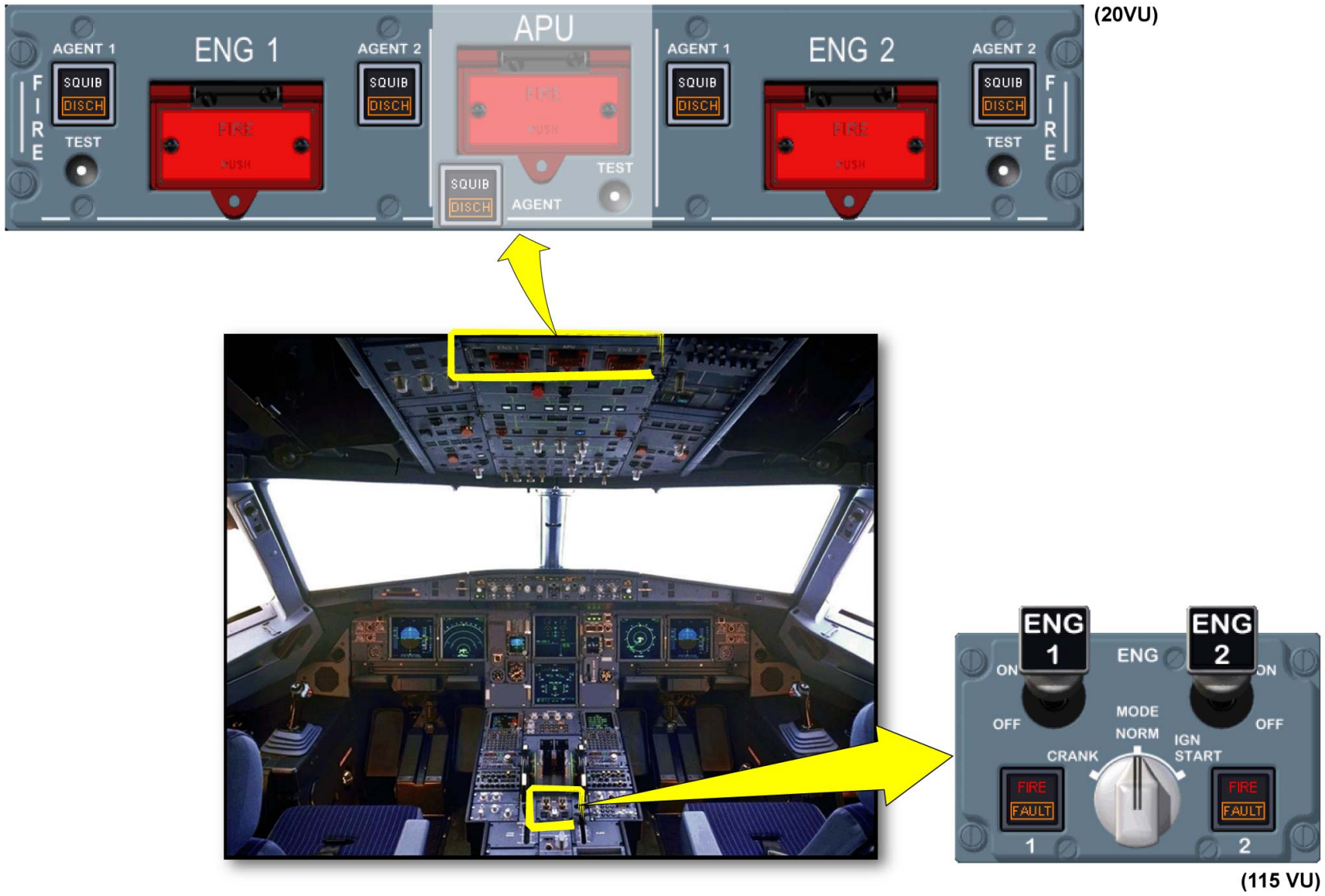


ENGINE FIRE PROTECTION - CONTROL AND INDICATING

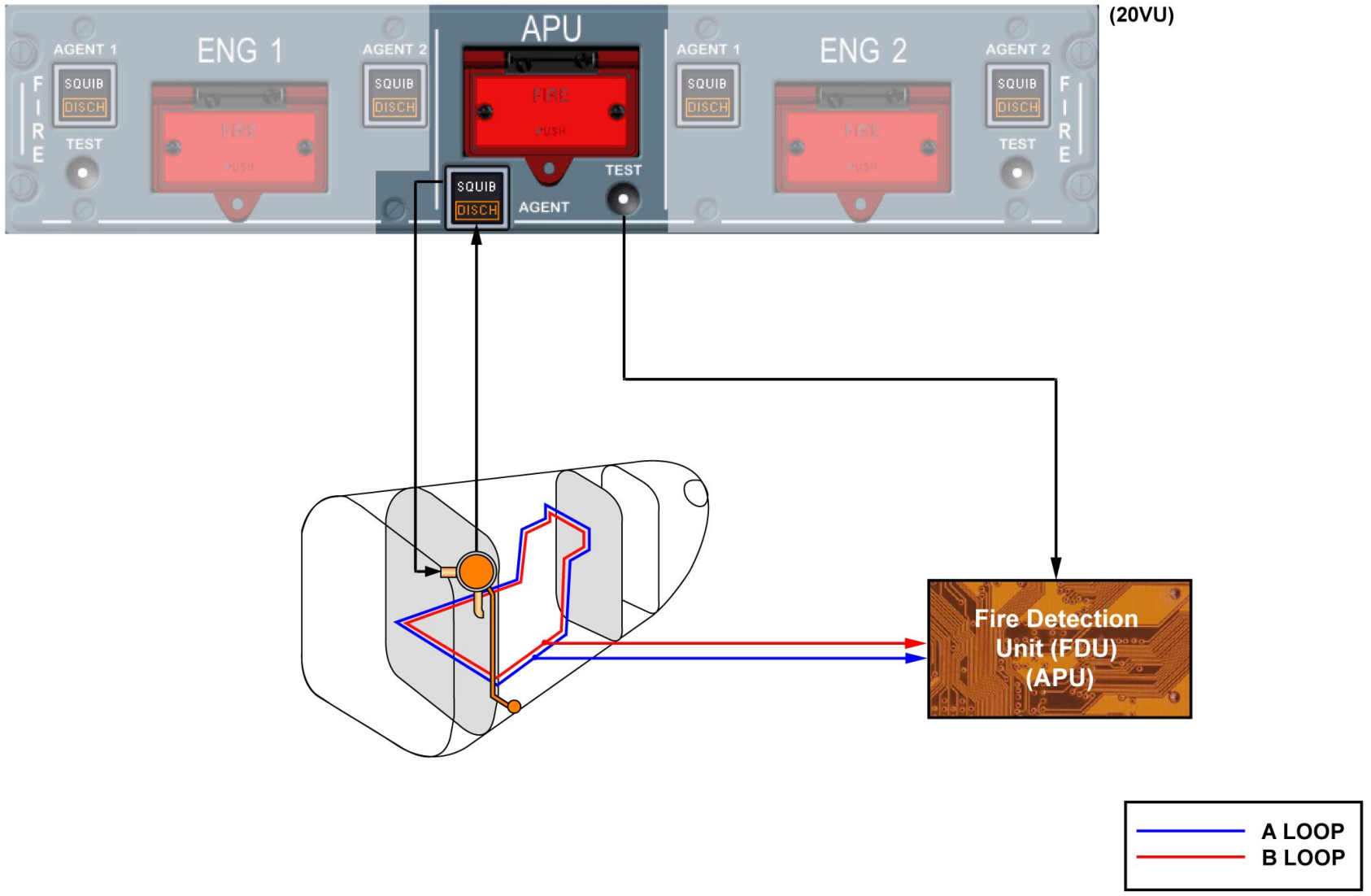
26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

APU FIRE PROTECTION

The APU fire protection is done by two sub-systems: the FIRE detection system and the FIRE extinguishing system.

DETECTION AND EXTINGUISHING

The detection system has two identical detection loops (A and B) mounted in parallel. Each loop has a single detector element. Both loops are monitored by a FDU. The FDU sends FIRE and FAULT signals to the FWC for display on ECAM.
The guarded FIRE P/B switches give a FIRE indication and the means to isolate affected systems. When the FIRE P/B is released out, fuel, electrical power and bleed supply are cut off and the APU is immediately shut down. This also arms the extinguishing system.
For the APU, there is just one fire extinguisher bottle. It is discharged by a single AGENT P/B switch. On the ground, an APU FIRE will trigger an APU automatic shutdown and discharge the bottle automatically.
The TEST button is used to test the fire detection and extinguishing system operation.



APU FIRE PROTECTION - DETECTION AND EXTINGUISHING

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

APU FIRE PROTECTION (continued)

CONTROL AND INDICATING

The detection and extinguishing functions are done from the overhead FIRE panel.
If an APU FIRE is detected on the ground, an auto-extinguishing system will automatically stop the APU and discharge the fire bottle into the APU compartment. A test of the auto-extinguishing system can be done from the maintenance test panel, on the overhead panel.
If an APU FIRE occurs on the ground, ground personnel are alerted by a warning horn in the nose wheel well and an APU FIRE indicator light on the external power panel on the lower fuselage.

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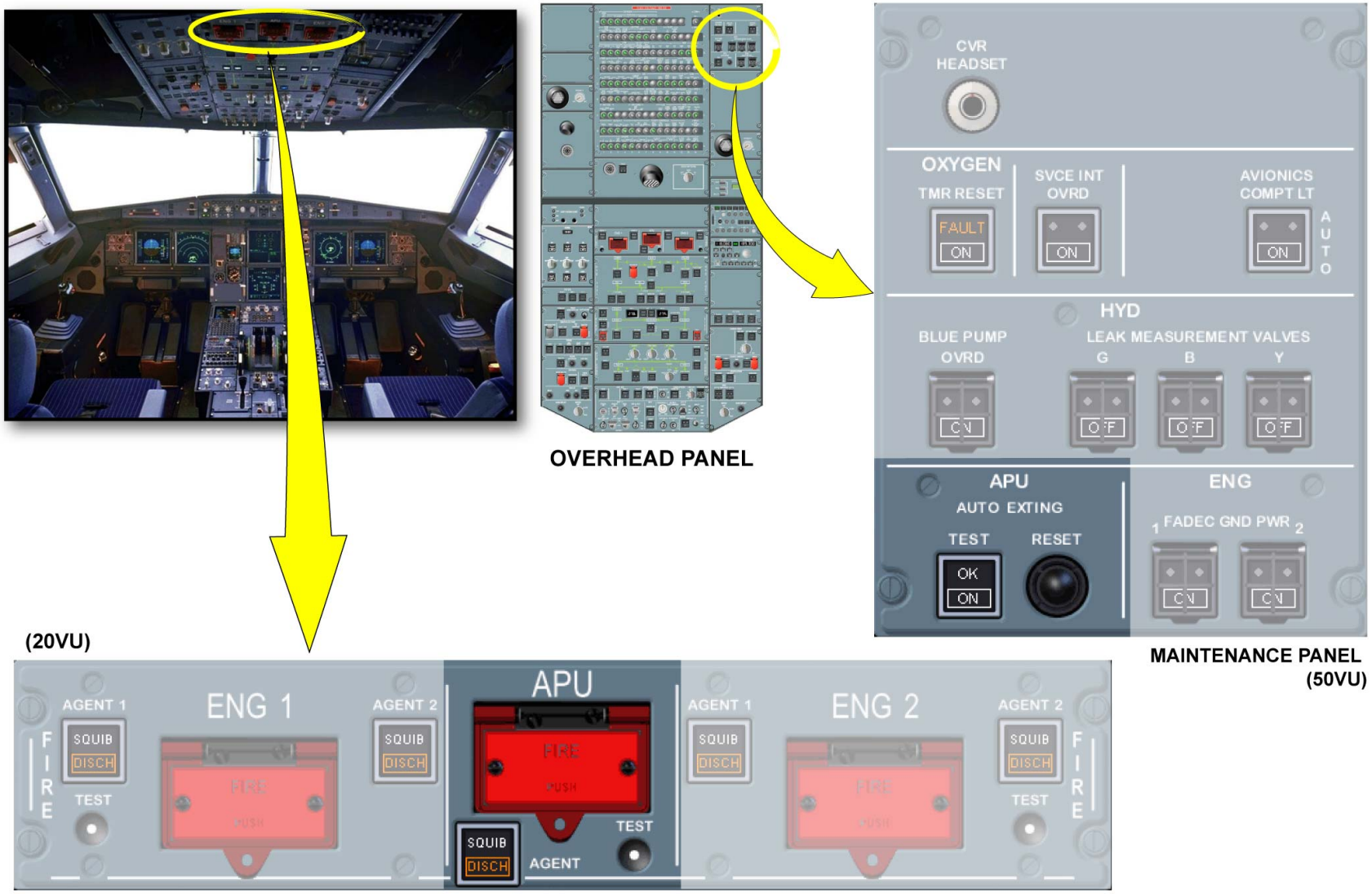
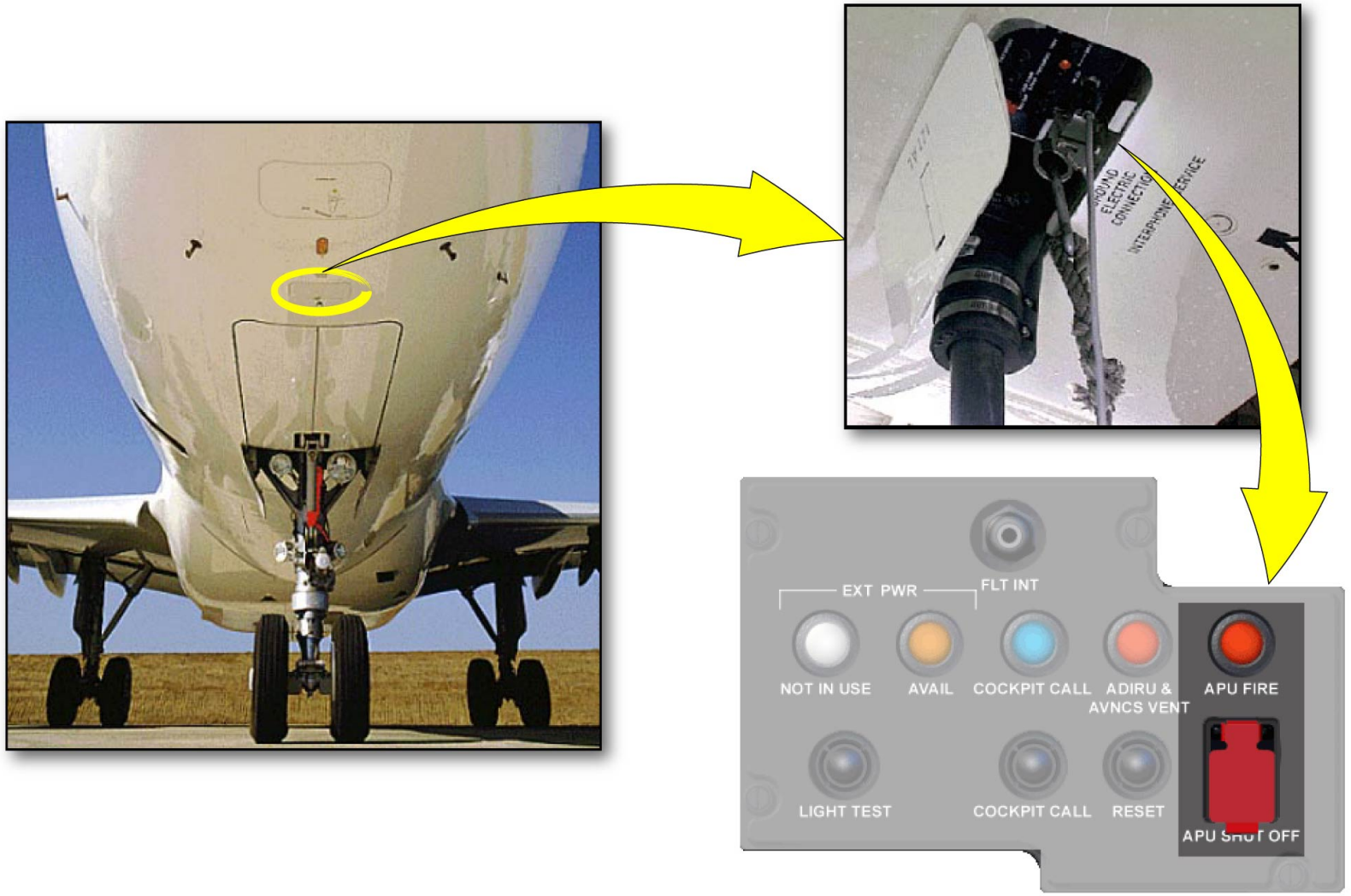


APU FIRE PROTECTION - CONTROL AND INDICATING



EXTERNAL POWER CONTROL PANEL (108VU)

APU FIRE PROTECTION - CONTROL AND INDICATING

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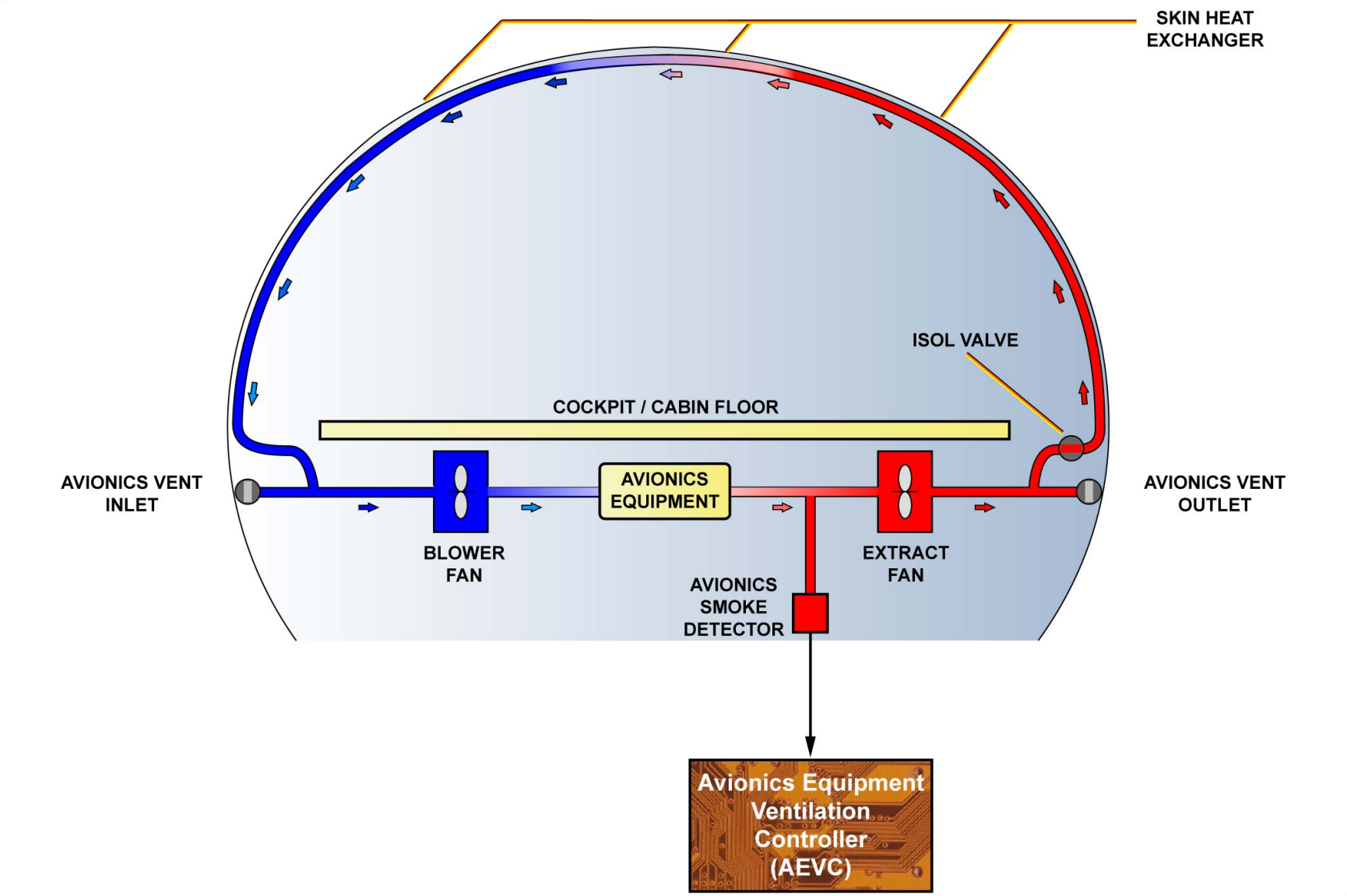
26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

AVIONICS COMPARTMENT SMOKE DETECTION

The aircraft has a cooling system for the avionics equipment. The cooling system is controlled and monitored by the Avionics Equipment Ventilation Controller (AEVC). The air is circulated through the system by a blower fan (cool air supply) working together with an extraction fan (warm air removal).
The extraction airflow is downstream of the avionics equipment, so the avionics SMOKE detector is installed in the extraction duct and will detect smoke coming from the computers and control boxes. The detector is monitored by the AEVC. The smoke detector directly sends the signal to FWC for the AVIONICS SMOKE warning in the cockpit.

UGB13131 - U2AT4M0 - UM26PZ00000002



AVIONICS COMPARTMENT SMOKE DETECTION

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

AVIONICS COMPARTMENT SMOKE DETECTION (continued)

CONTROL AND INDICATING

Avionics SMOKE is indicated on two overhead panels in the cockpit. Pilot action on both panels is required as part of the AVIONICS SMOKE procedure in flight.
- On the EMER ELEC PWR panel, the SMOKE light comes on in the GEN 1 LINE P/B switch.
- On the VENTILATION panel, the FAULT light comes on in both BLOWER and EXTRACT P/B switches.

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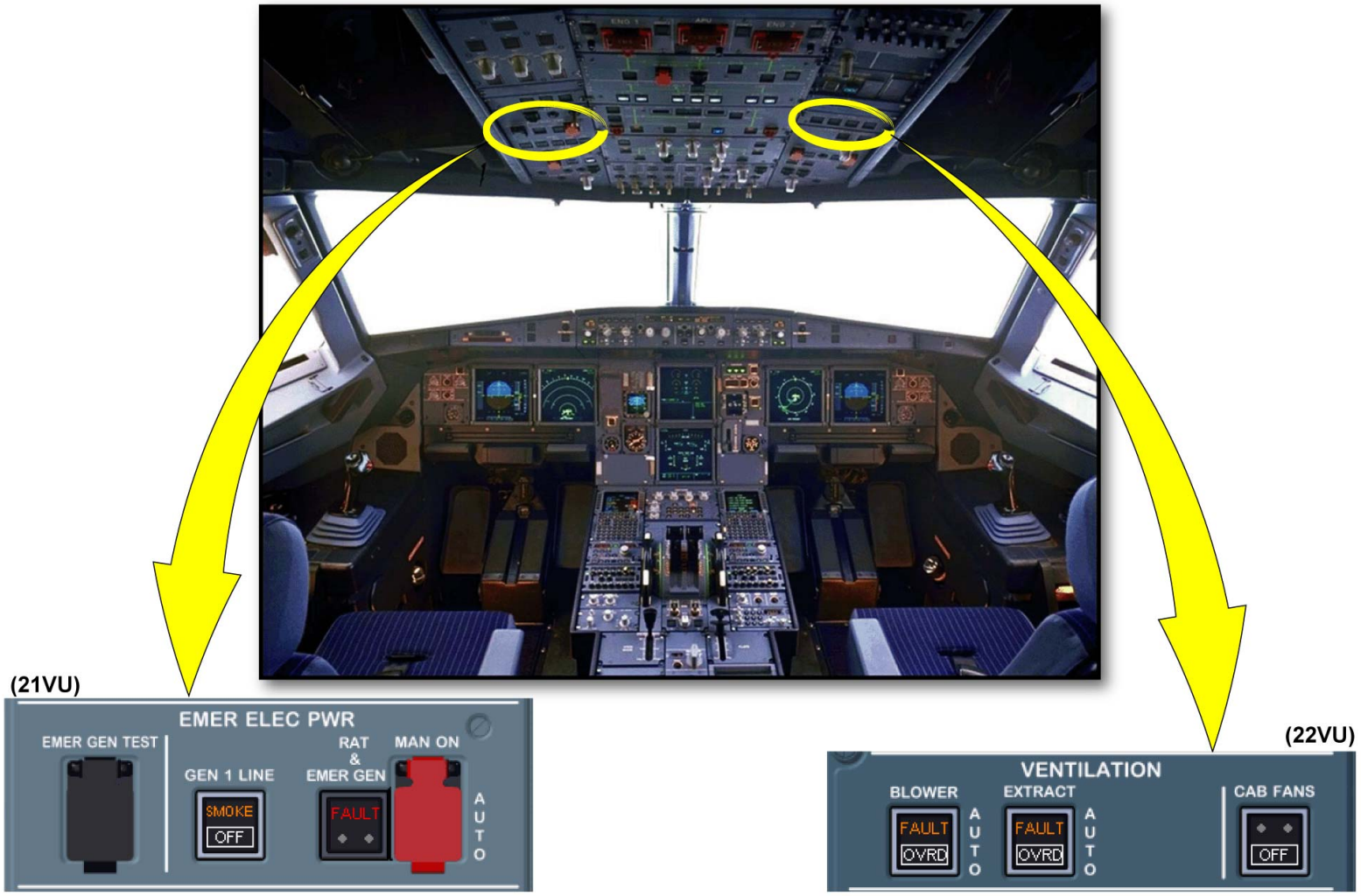

AVIONICS COMPARTMENT SMOKE DETECTION - CONTROL AND INDICATING

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

CARGO COMPARTMENT SMOKE PROTECTION

The cargo compartments are protected by the smoke detection system and the fire extinguishing system.

DETECTION AND FIRE EXTINGUISHING

Each cargo compartment has cavities, and each cavity contains 2 smoke detectors.
On the A321, there are additional smoke detectors because of the larger size of the cargo compartments.
The cargo compartments are ventilated by an air extraction system. The air flows continuously through the compartment and across the detectors and is extracted out through the rear wall. The smoke detectors are monitored by the Smoke Detection Function (SDF) which is integrated in the Cabin Intercommunication Data System (CIDS). The SDF receives signals from the detectors and sends SMOKE or FAULT warnings to the FWC to alert the flight crew.
The cargo compartment fire extinguishing agent is discharged into the FWD compartment by one nozzle (two for the A321) or into the AFT compartment by two nozzles (three for the A321). The standard system includes one extinguishing bottle. An optional system includes two bottles. The second bottle is necessary for extended range operations.

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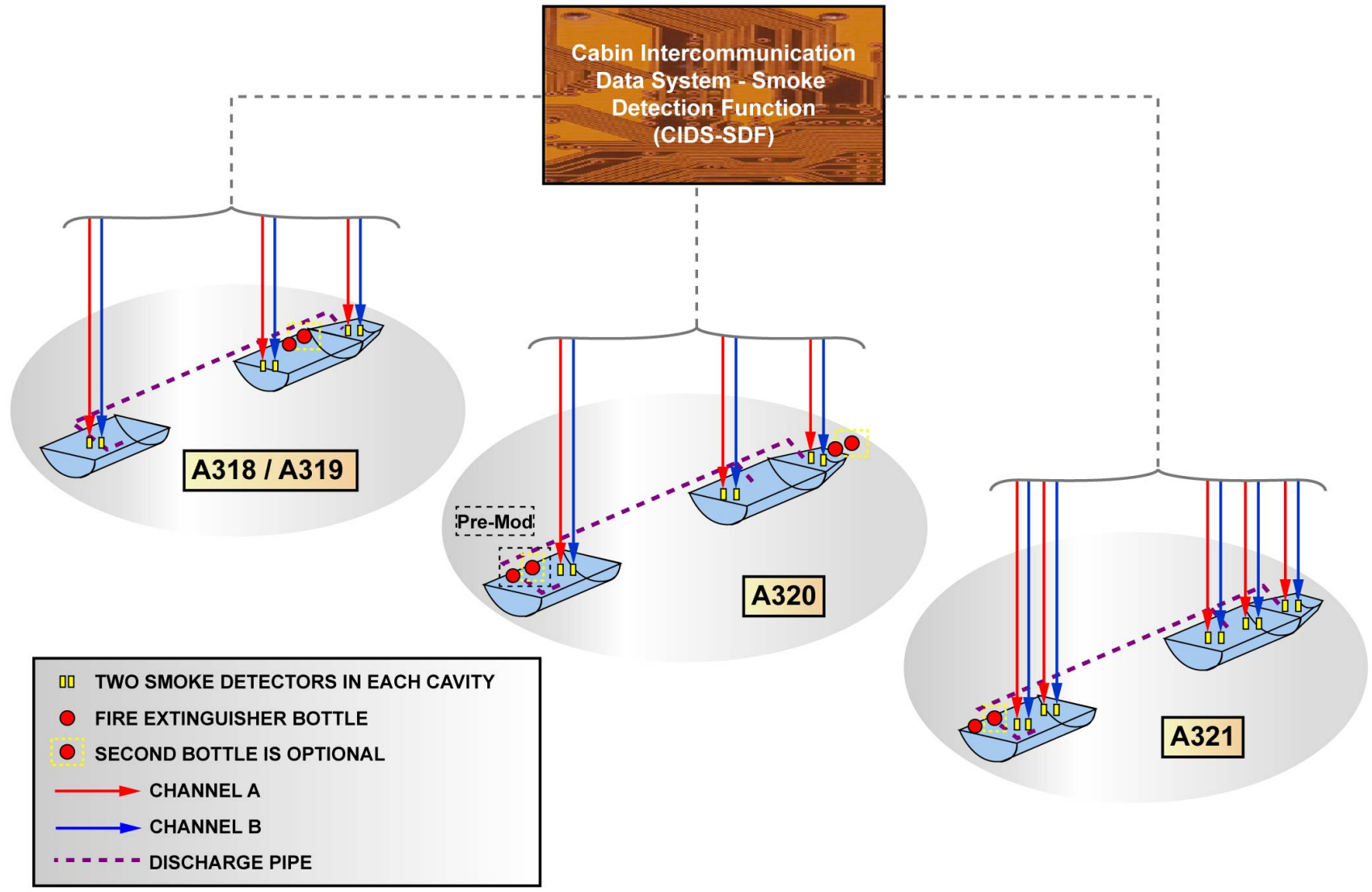


CARGO COMPARTMENT SMOKE PROTECTION - DETECTION AND FIRE EXTINGUISHING

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

CARGO COMPARTMENT SMOKE PROTECTION (continued)

CONTROL AND INDICATING

The cargo smoke panel on the overhead handles both detection and extinguishing functions. The standard and optional panels are shown.

(22VU)

(22VU)

(OPTIONAL: 2-BOTTLE SYSTEM PANEL)

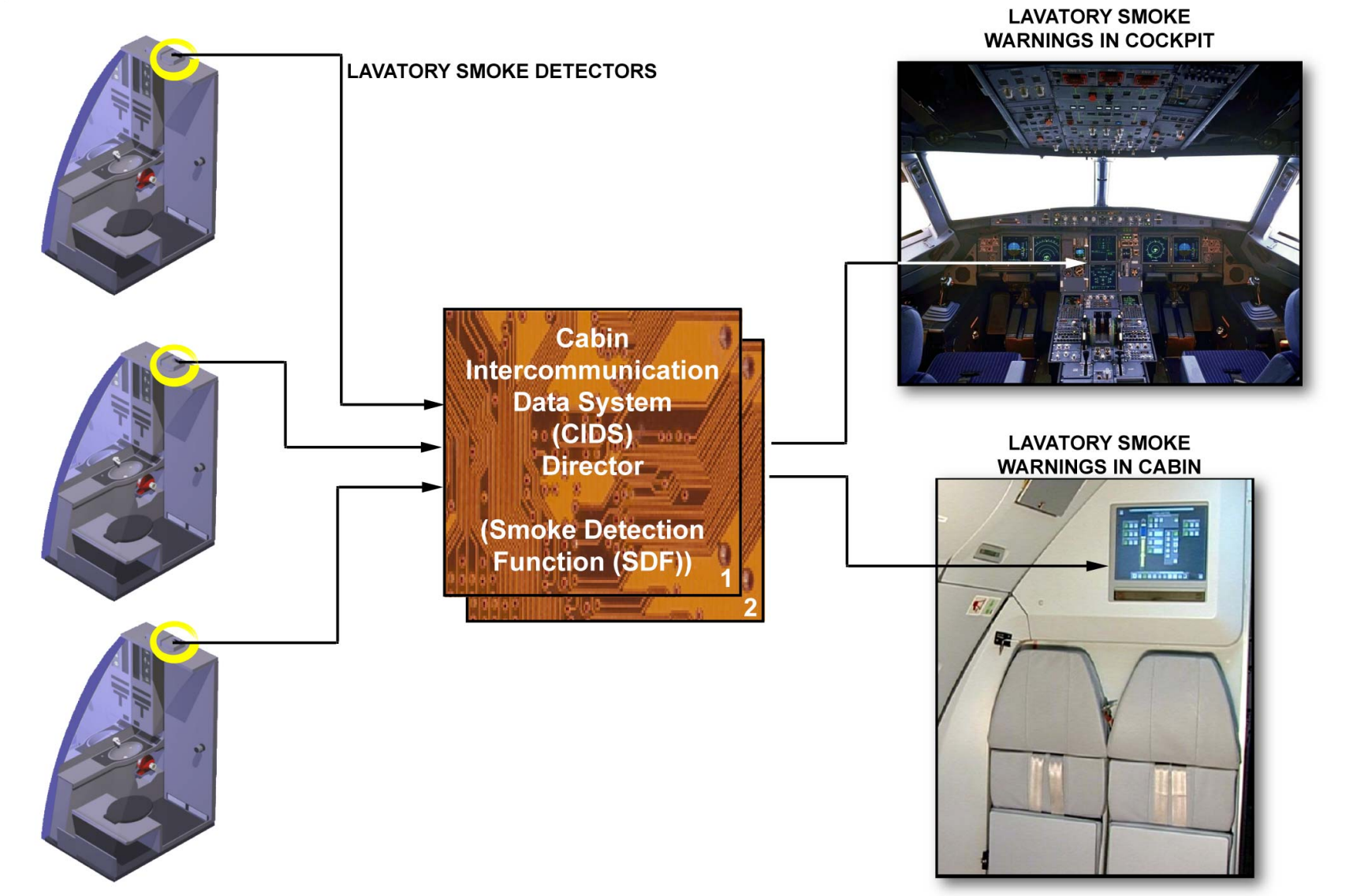
CARGO COMPARTMENT SMOKE PROTECTION - CONTROL AND INDICATING

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

LAVATORY SMOKE PROTECTION

Each lavatory has one smoke detector. The lavatories and galleys on the aircraft are ventilated by an air extraction system. Air continuously circulates through the lavatories and is extracted out through the ceiling and across the smoke detectors.
The lavatory smoke detectors are monitored by the SDF, which is integrated into the CIDS computer(s) called the Director 1(2). The SDF receives signals from the detectors and sends SMOKE or FAULT warnings to the FWC to alert the flight crew. In addition, LAV SMOKE warnings are sent to the CIDS to alert the cabin crew.

UGB13131 - U2AT4M0 - UM26PZ00000002



LAVATORY SMOKE PROTECTION

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

CABIN FIRE PROTECTION

There are portable fire extinguishers in the cockpit and the cabin.
The quantity, type and location of the portable extinguishers depends on the each customer's interior configuration.

UGB13131 - U2AT4M0 - UM26PZ00000002

TYPICAL COCKPIT INSTALLATION

TYPICAL CABIN INSTALLATION
(FLIGHT ATTENDANT SEAT)

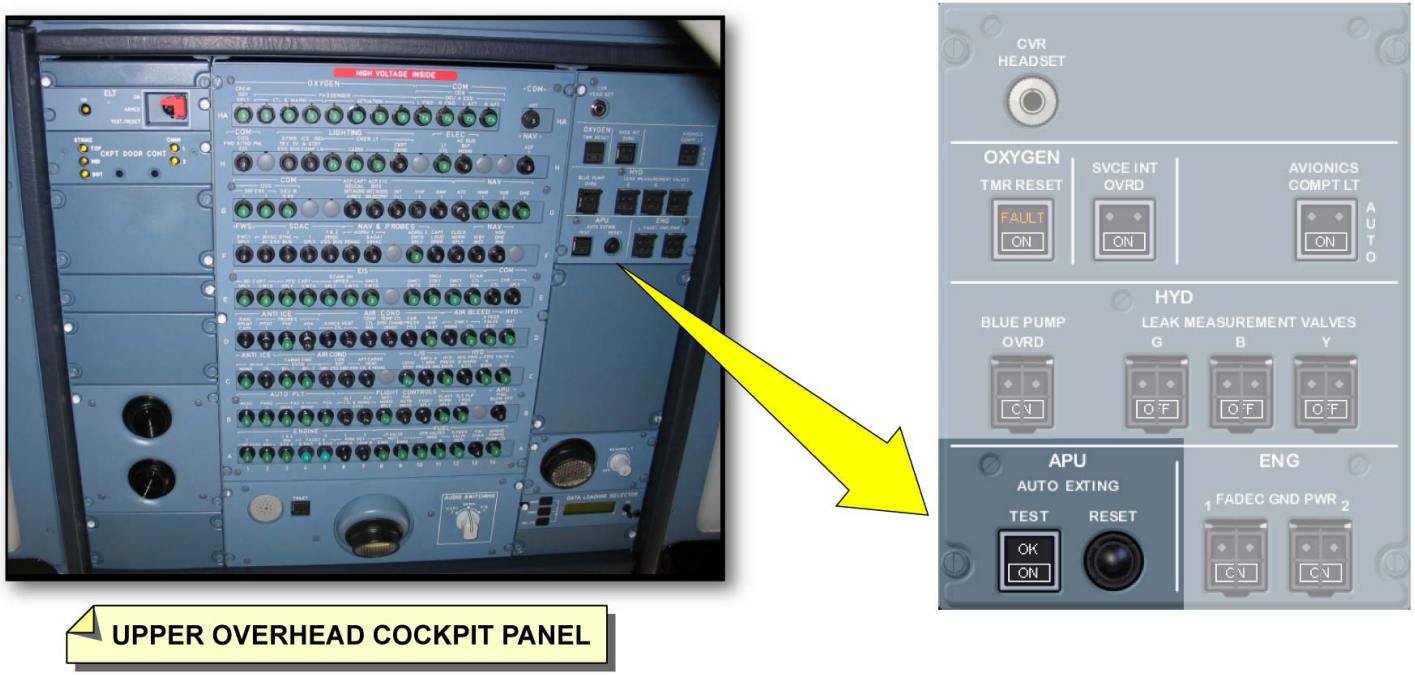
PORTABLE FIRE EXTINGUISHER

CABIN FIRE PROTECTION

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

SPECIFIC FUNCTION

In case of an APU FIRE detected on the ground, an auto-extinguishing system will automatically shut down the APU and discharge the fire bottle into the APU compartment. The auto-extinguishing system can be tested through the maintenance test panel located on the overhead panel.

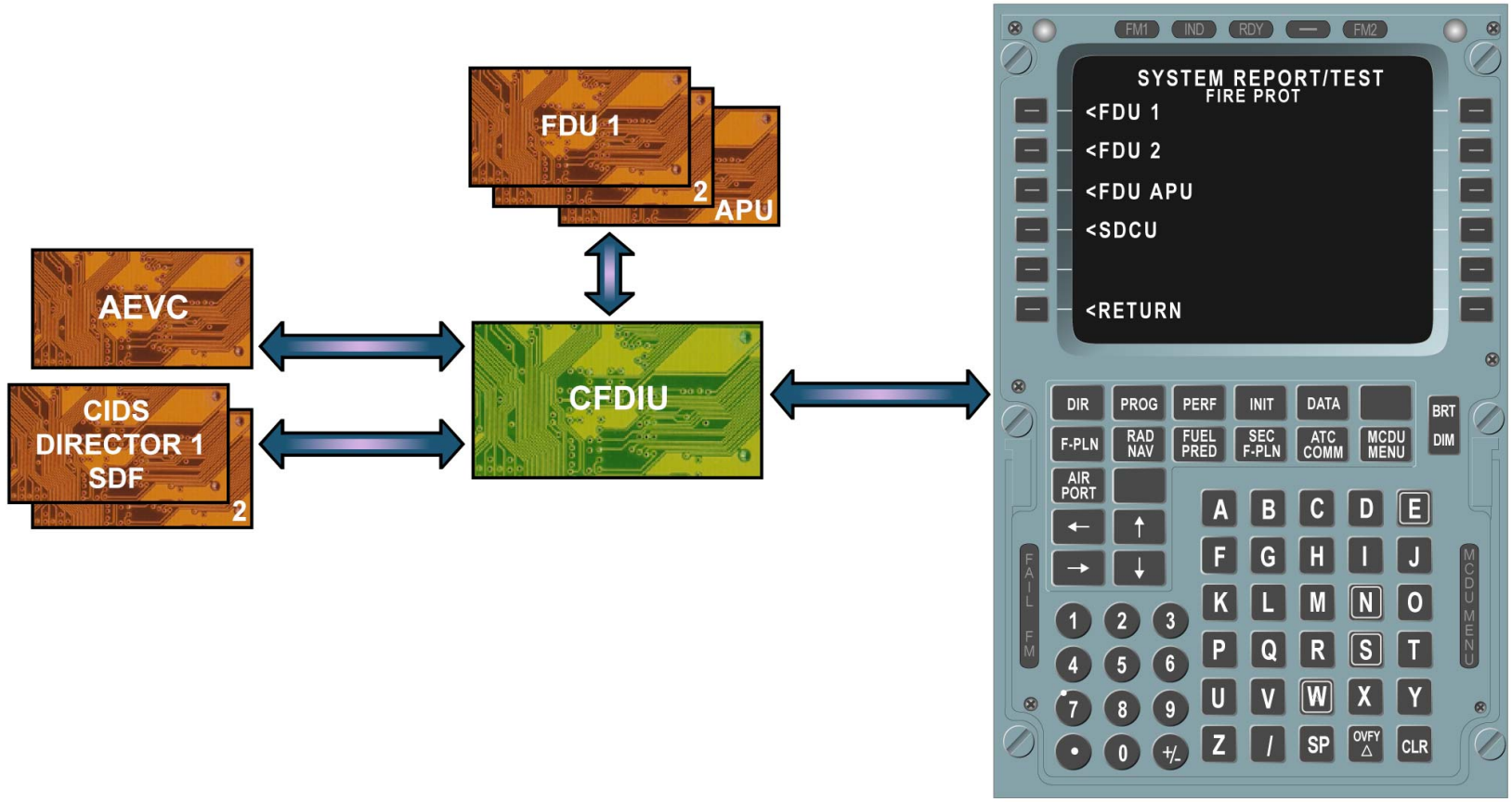


SPECIFIC FUNCTION

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The FDU processes signals issued from the sensing element responder and continuously transmits messages to the Centralized Fault Display Interface Unit (CFDIU).
The AEVC tests the smoke detector of the avionics compartment.
The two CIDS directors (SDF) monitor the smoke detectors installed in the cargo compartment and in the lavatories. FAULT information is sent to the CFDIU.



AEVC - Avionics Equipment Ventilation Computer
FDU - Fire Detection Unit
CFDIU - Centralized Fault Display Interface Unit
CIDS - Cabin Intercommunication Data System
SDF - Smoke Detection Function

MAINTENANCE/TEST FACILITIES

26 FIRE PROTECTION SYSTEMS PRESENTATION (1)

SAFETY PRECAUTIONS

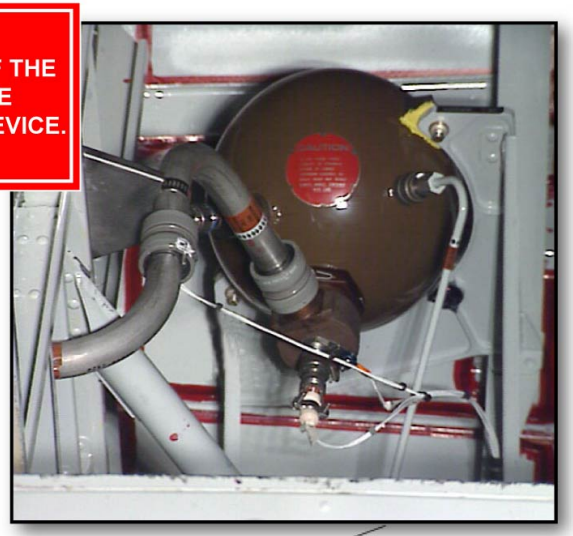
When you work on aircraft, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures. This will prevent injury to personnel and/or damage to the aircraft. Here is an overview of main safety precautions related to the fire protection system.
Do not try to open or repair the smoke detectors. Only workshops authorized by the manufacturer can do work on the smoke detectors.
The cartridge is an explosive device. To prevent explosion of the cartridge, install the applicable protective device. This will protect the electrical connector of the cartridge. Do not use a foil shunt.
When installing engine or APU fire detection elements, be careful not to bend or damage the element.
The engine and APU fire extinguishing bottles are connected to a HOT BUS. Make sure to pull all applicable C/Bs when doing maintenance on these systems, even without electrical power supplied to the aircraft.

UGB13131 - U2AT4M0 - UM26PZ00000002

ENGINE AND APU FIRE PANEL (20VU)

WARNING

TO PREVENT EXPLOSION OF THE CARTRIDGE INSTALL THE APPLICABLE PROTECTIVE DEVICE.

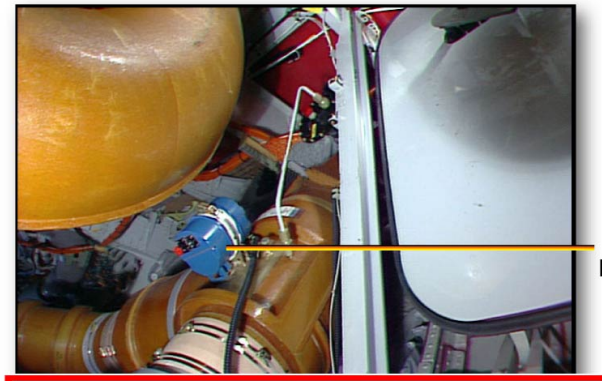


WARNING

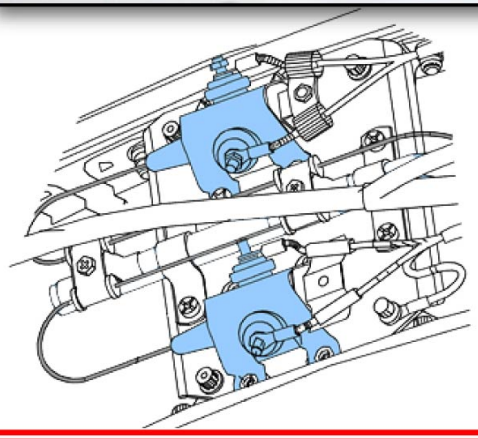
THE ENGINE AND APU FIRE EXTINGUISHING BOTTLES ARE CONNECTED TO A HOT BUS. MAKE SURE TO PULL ALL APPLICABLE C/BS.

WARNING

OBEY ALL THE AMM SAFETY PROCEDURES.



SMOKE DETECTOR



WARNING

DO NOT TRY TO OPEN OR REPAIR THE SMOKE DETECTORS. ONLY AUTHORIZED WORKSHOPS CAN WORK ON THE SMOKE DETECTORS.

WARNING

WHEN INSTALLING ENGINE OR APU FIRE DETECTION ELEMENTS, BE CAREFUL NOT TO BEND OR DAMAGE THE ELEMENT.

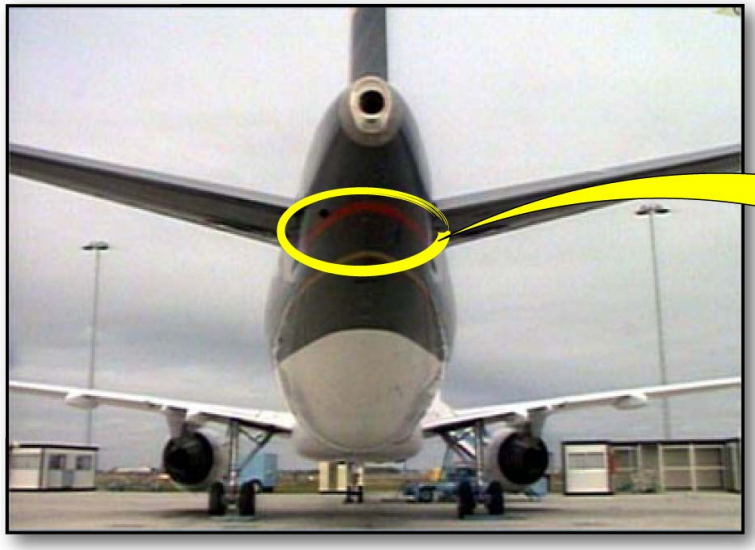
SAFETY PRECAUTIONS

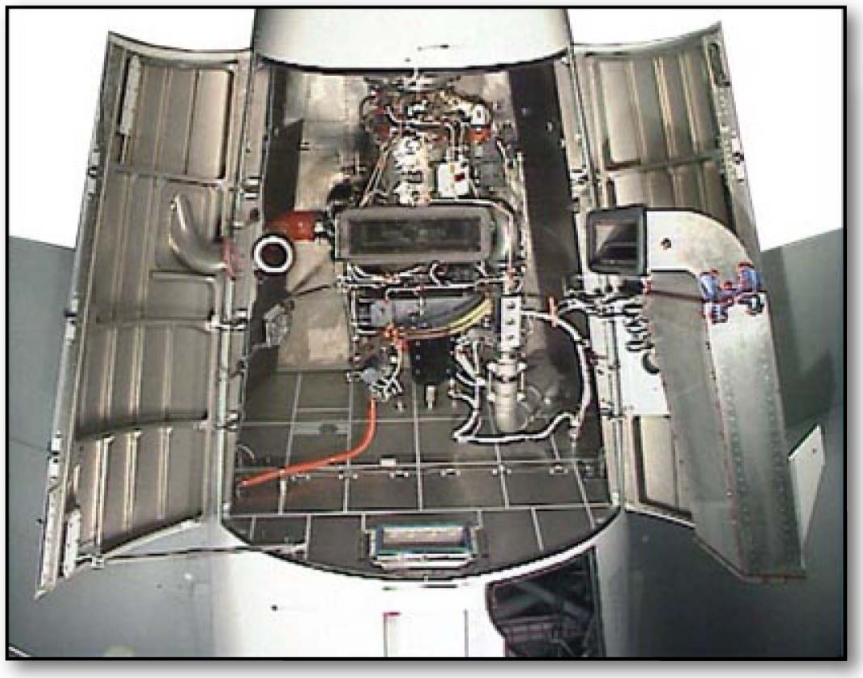
49 APU PRESENTATION (1)

GENERAL

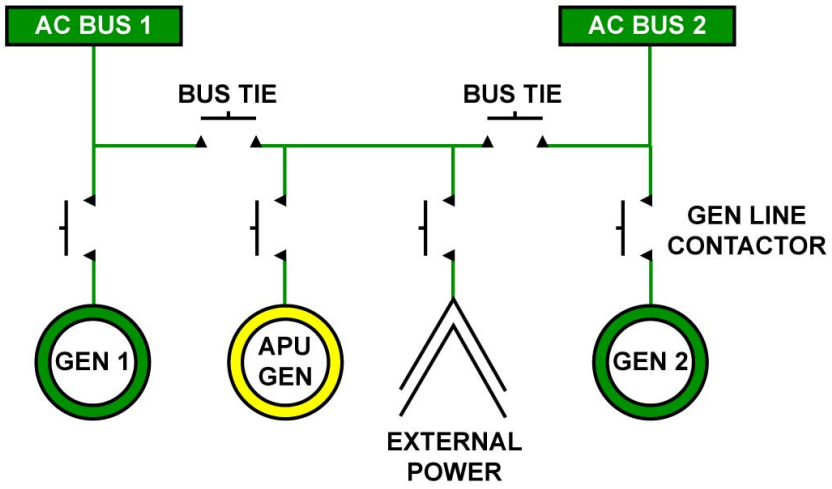
The Auxiliary Power Unit (APU) is a constant-speed gas turbine engine installed in the tail cone. The APU is a self-contained unit. With the APU, the A/C is independent of external pneumatic and electrical power sources.
The APU is designed to operate during all the flight envelope.
Electrical power is available while the APU operates, but if a back-up bleed source is necessary in flight, APU bleed air is available until a maximum altitude of FL200 for the APIC 3200 and FL225 for the Honeywell 131-9.
The APU can supply:
- Electrical power for the A/C systems,
- Bleed air for engine starting and air conditioning on the ground,
- Bleed air for air conditioning/pressurization in flight.

The APU is installed in its compartment in the tail cone.
The Air Intake Flap and Duct assembly let air flow to the APU air inlet plenum.
Different components (the APU Bleed duct, the APU Generator output feeder cable, the APU fuel supply manifold, etc.) go through the front firewall.
The Air Intake Flap actuator operates the air intake flap and lets air go into the plenum.
The hot gases from the power section and unused APU bleed air are released through the Exhaust pipe.

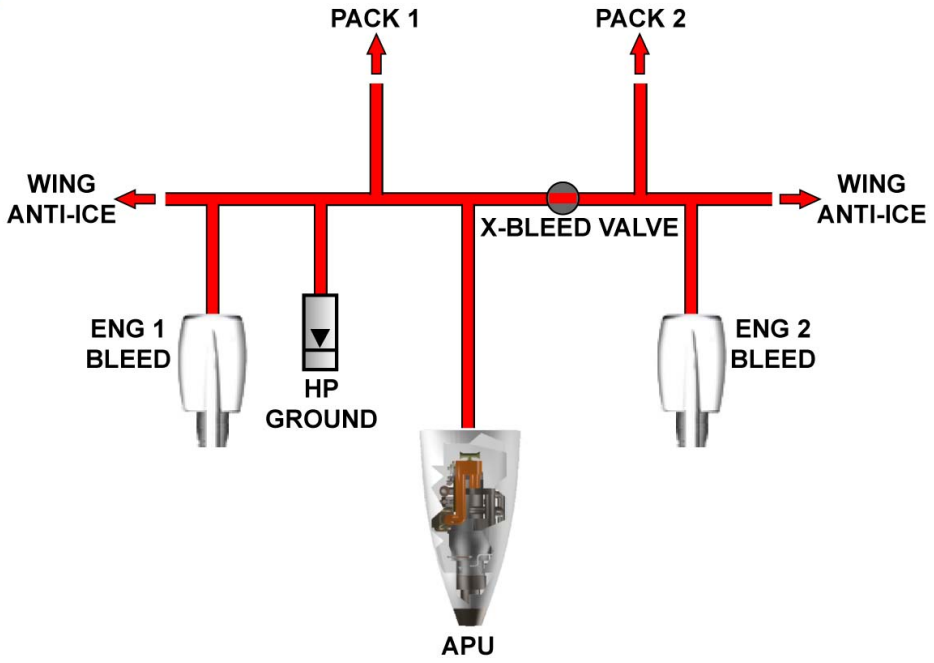




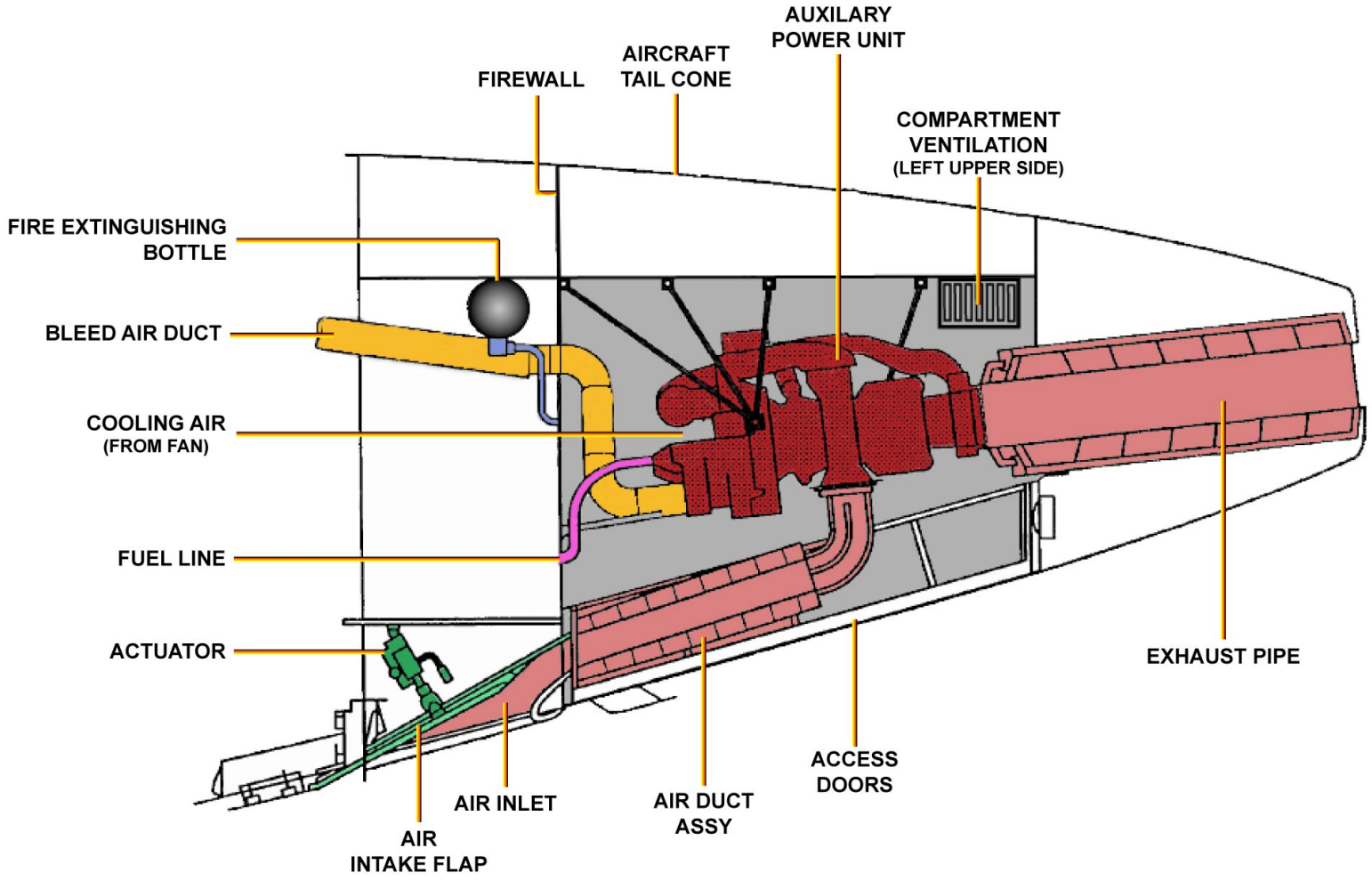
GENERAL



The APU supplies electrical power and bleed air on the ground and in flight



GENERAL


AUXILARY
POWER UNIT
AIRCRAFT
TAIL CONE
FIREWALL
COMPARTMENT
VENTILATION
(LEFT UPPER SIDE)
FIRE EXTINGUISHING
BOTTLE
BLEED AIR DUCT
COOLING AIR
(FROM FAN)
FUEL LINE
ACTUATOR
EXHAUST PIPE
ACCESS
DOORS
AIR DUCT
ASSY
AIR INLET
AIR
INTAKE FLAP

GENERAL

49 APU PRESENTATION (1)

GENERAL (continued)

ENGINE DESCRIPTION - HONEYWELL

The APU is a constant speed, single-shaft gas turbine engine that supplies mechanical shaft power to operate an accessory gearbox and a load compressor. The shaft is held with two bearings: one duplex ball bearing in front of the load compressor impellor and a roller bearing aft of the second stage turbine. As an option, the duplex ball bearing is made of ceramic to make the bearing more resistant against damage caused by debris that go into the bearing compartment. The gearbox drives the APU generator.

The Load Control Valve supplies pneumatic power to start the air conditioning. A Surge Control Valve also gives protection to the load compressor against insufficient flow.

The APU operation is controlled and monitored by the Electronic Control Box (ECB). The ECB has full authority over the following APU functions:

- Starting,
- Acceleration,
- Speed governing,
- Indication,
- Fault monitoring,
- Interface with A/C systems.

The APU is capable of unattended operation; therefore, the ECB automatically shuts down the APU in case of a FAULT to protect the APU. Based on regulations, in-flight protective shutdowns may be inhibited, except for critical FAULTs.

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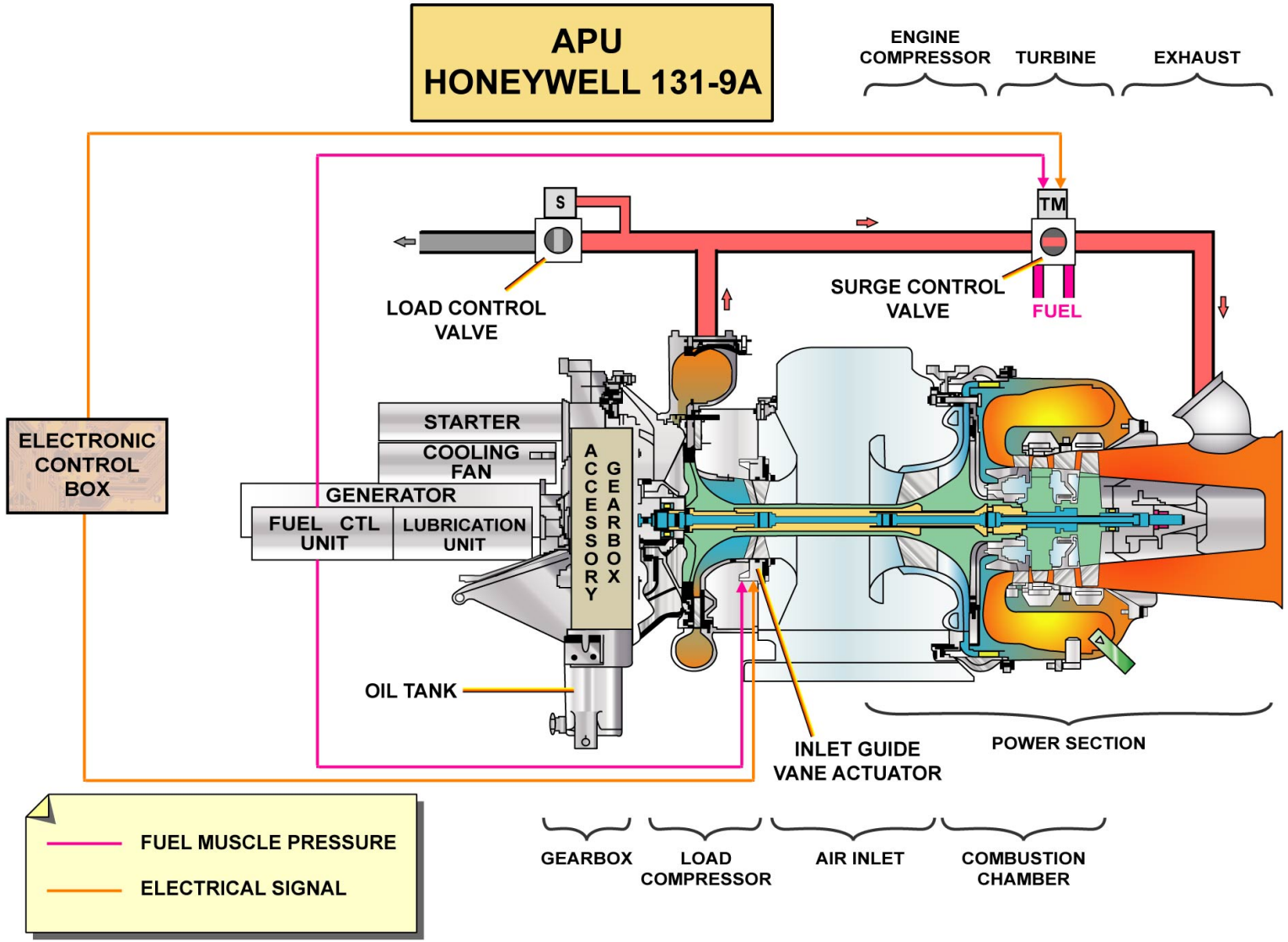

GENERAL - ENGINE DESCRIPTION - HONEYWELL

49 APU PRESENTATION (1)

GENERAL (continued)

ENGINE DESCRIPTION - APIC

The APU is a constant speed, single-shaft gas turbine engine that delivers mechanical shaft power to drive an accessory gearbox and a load compressor. The APU generator is driven by the gearbox.
The Bleed Control valve provides the pneumatic power for starting, air conditioning and it integrates the protective Surge Control function required to protect the load compressor against insufficient flow.
The APU operation is controlled and monitored by the Electronic Control Box (ECB). The ECB has full authority over the following APU functions:
- Starting,
- Acceleration,
- Speed governing,
- Indication,
- Fault monitoring,
- Interface with A/C systems.

The APU is capable of unattended operation; therefore, the ECB automatically shuts down the APU in case of a FAULT to protect the APU. Based on regulations, in-flight protective shutdowns may be inhibited, except for critical FAULTs.

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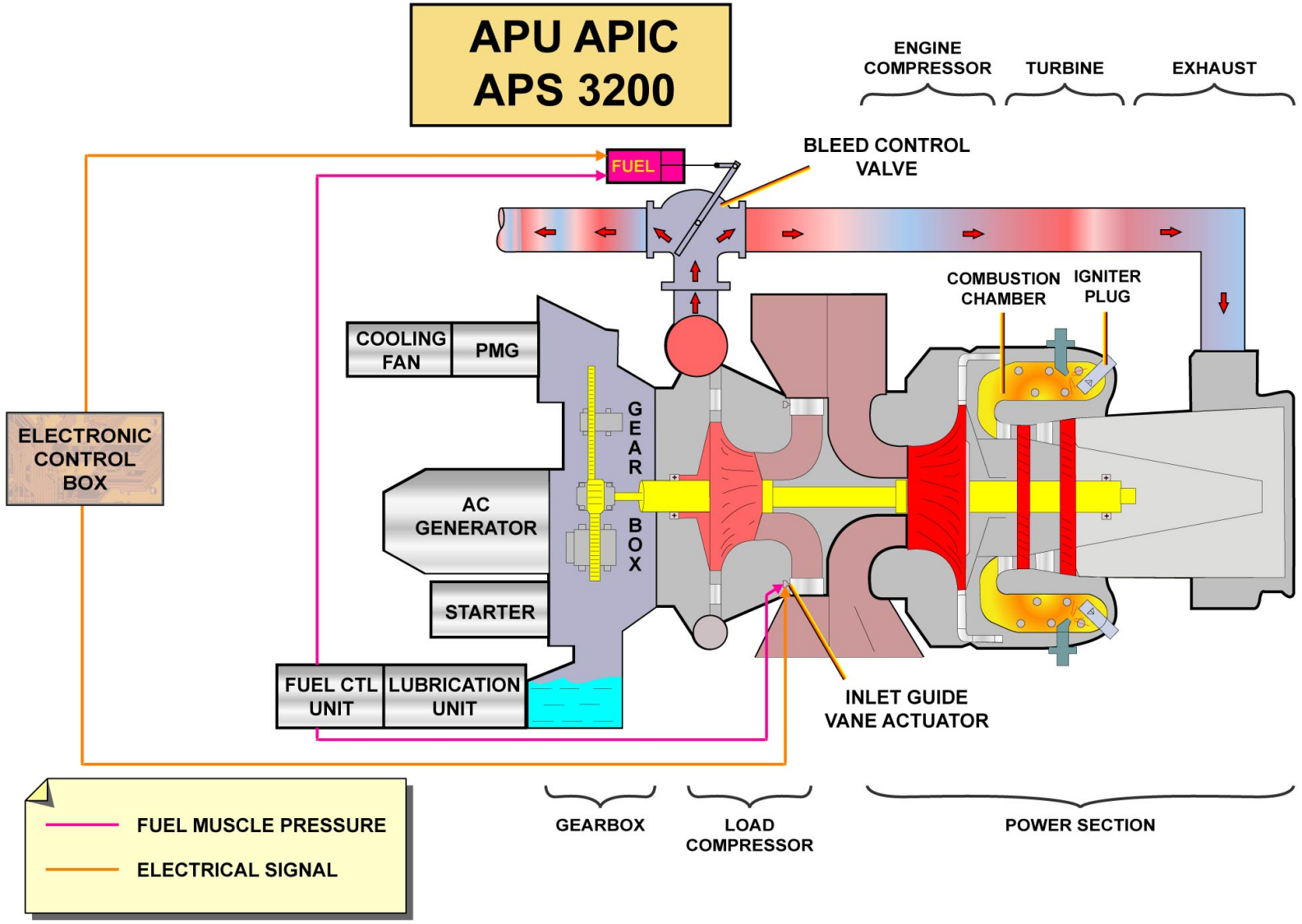


GENERAL - ENGINE DESCRIPTION - APIC

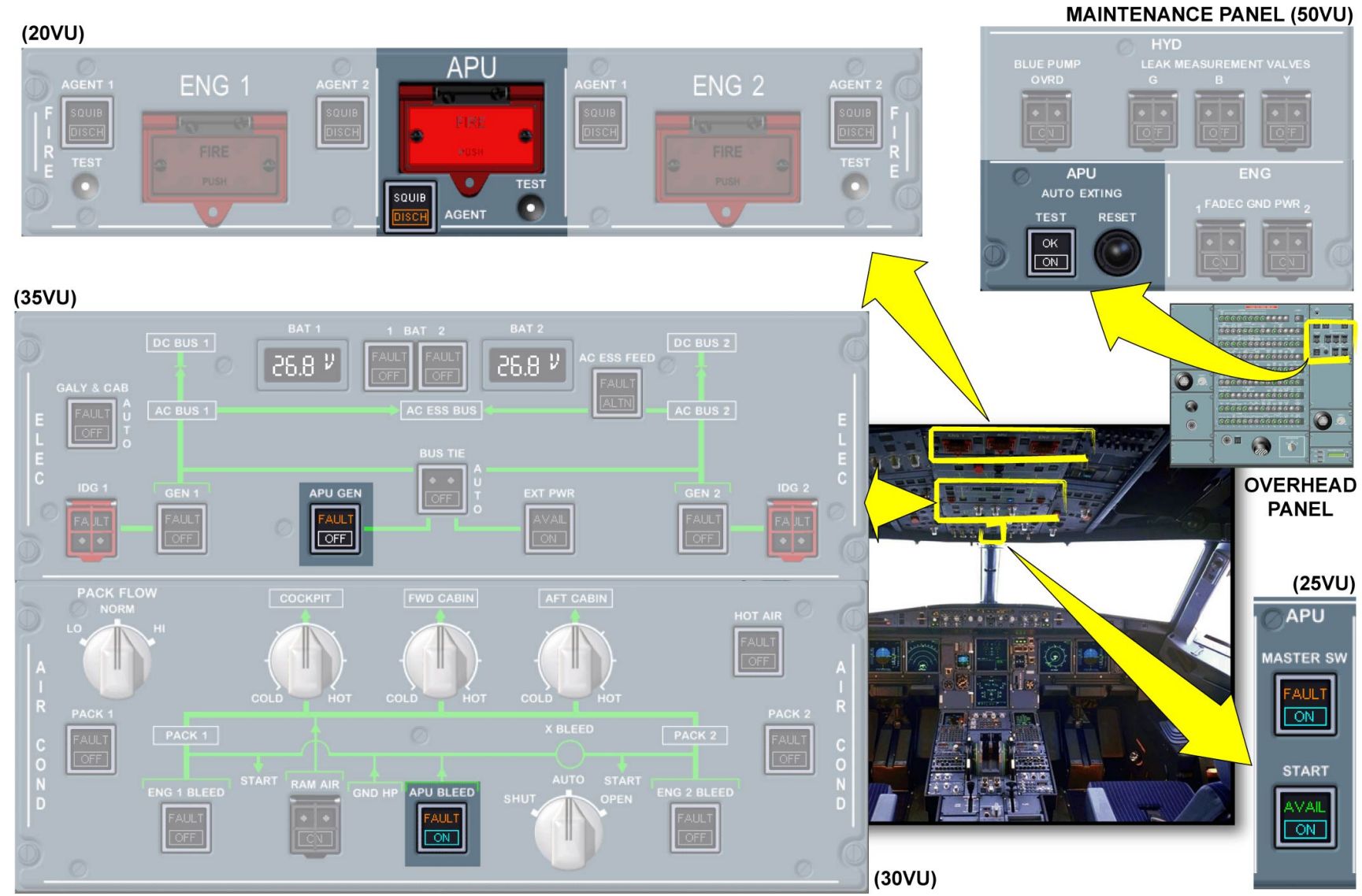
49 APU PRESENTATION (1)

CONTROL AND INDICATING

This section will highlight the control panels and indications for the APU.

CONTROL PANELS

The controls used to operate the APU are:
- The APU MASTER SWitch and START P/BSW, on the APU control panel,
- The APU fire controls, on the FIRE panel,
- Additionally, P/BSWs to deliver the electrical or pneumatic power, and to test the APU auto extinguishing circuits.



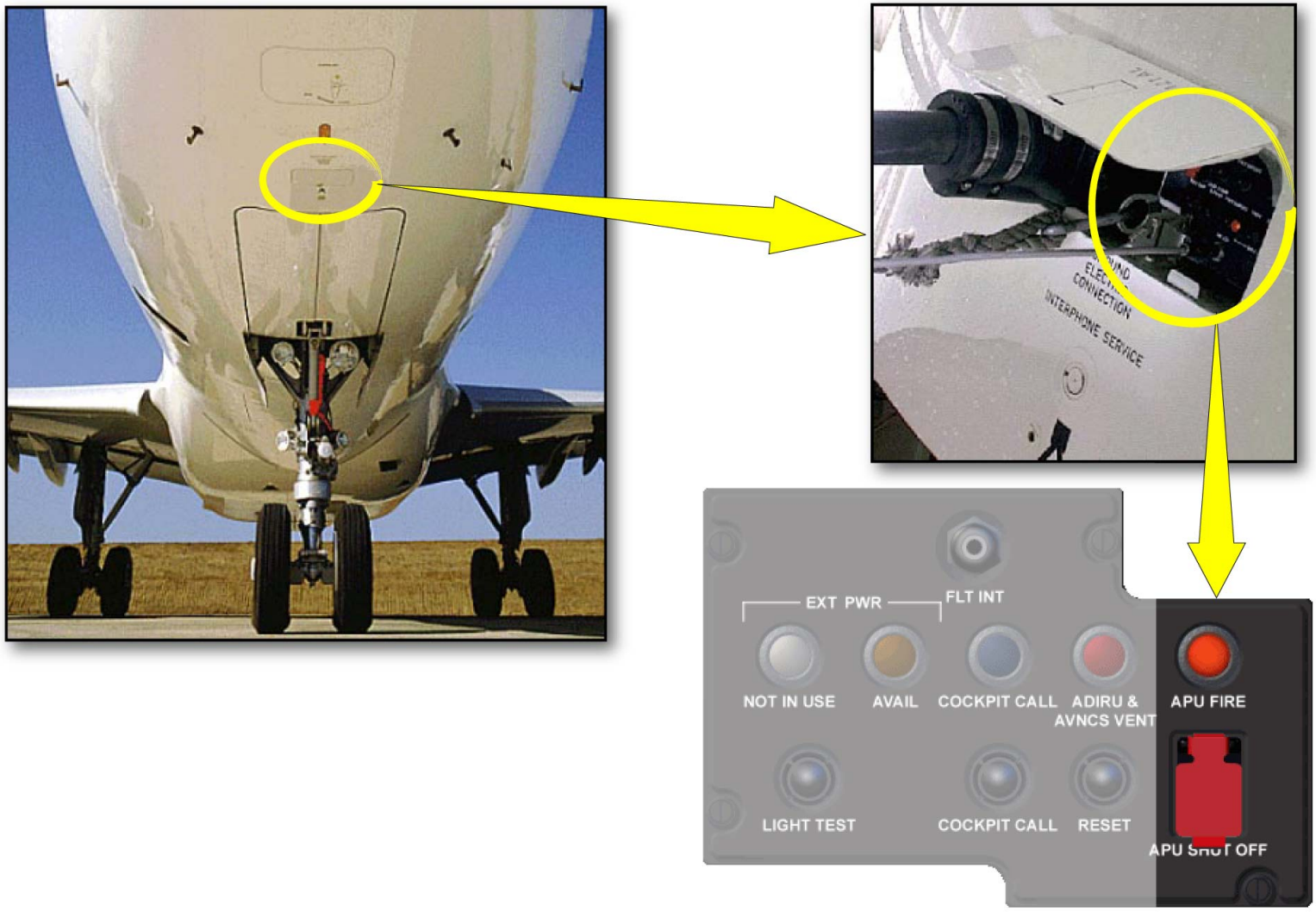
CONTROL AND INDICATING - CONTROL PANELS

49 APU PRESENTATION (1)

CONTROL AND INDICATING (continued)

EXTERNAL CONTROLS

If an APU FIRE warning occurs on the ground, a loud horn will be heard in the nose wheel well to alert ground personnel. A red APU FIRE light will also come on, on the external power control panel on the lower fuselage. It is possible to do an EMERGENCY shutdown of the APU from this panel. To do this, lift the guard and push the APU SHUT OFF P/BSW.



EXTERNAL POWER CONTROL PANEL (108VU)

CONTROL AND INDICATING - EXTERNAL CONTROLS

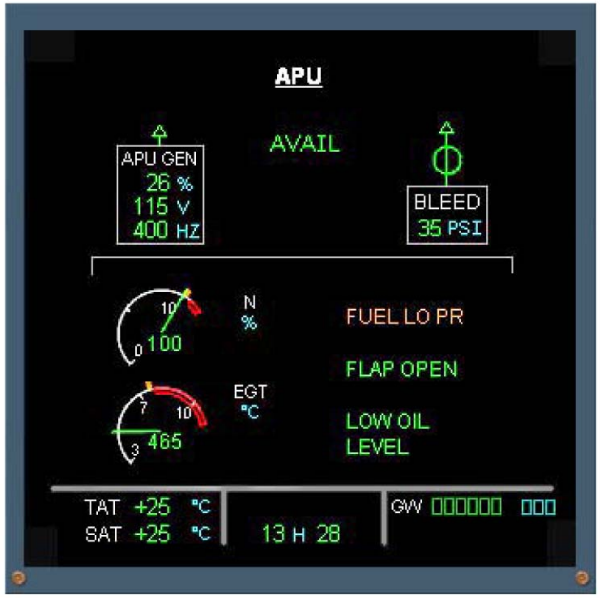
49 APU PRESENTATION (1)

CONTROL AND INDICATING (continued)

ECAM APU PAGE

APU parameters are displayed on the ECAM APU page. The APU generator parameters are duplicated on the ECAM ELEC page and the APU pneumatic parameters are duplicated on the ECAM BLEED page.

UGB13131 - U2AT4M0 - UM49PZ000000001



SYSTEM DISPLAY (SD)

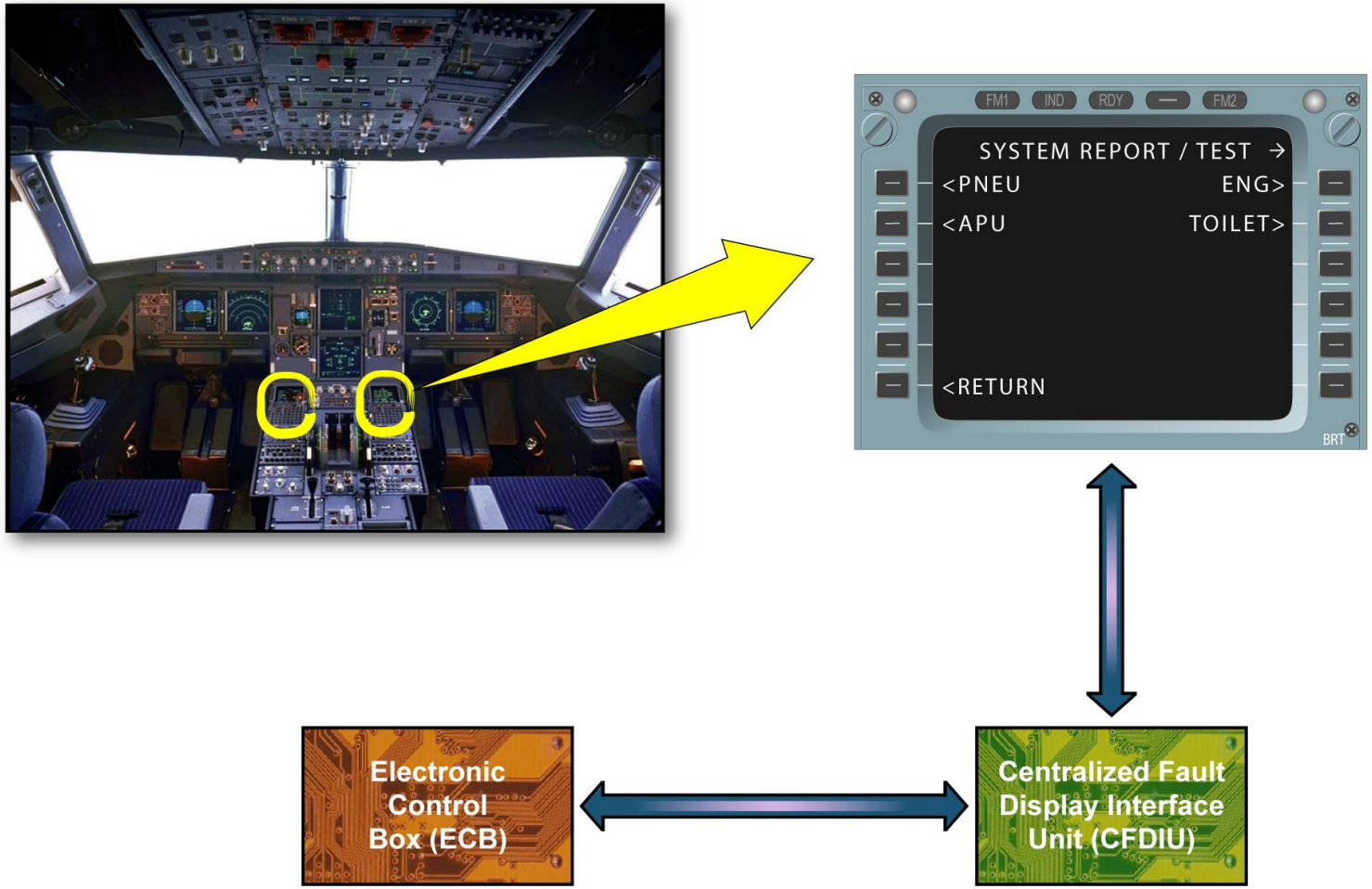
CONTROL AND INDICATING - ECAM APU PAGE

49 APU PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

Using the MCDU, you can have access to the Centralized Fault Display System (CFDS) fault messages of the APU system. Specific Built-In Test Equipment (BITE) tests are available as well.

UGB13131 - U2AT4M0 - UM49PZ00000001



MAINTENANCE/TEST FACILITIES

49 APU PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on A/C, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures. This will prevent injury to persons and/or damage to the A/C. Here is an overview of main safety precautions related to the APU.
Make sure that you use the correct personal protection when you work on the APU, as fuel and oil are poisonous.
Do not touch the APU until it is sufficiently cool.
If you operate the APU with the APU access doors open or removed, make sure that you have the correct fire fighting equipment available. The onboard APU fire extinguishing system is not sufficient when these doors are not closed.

WARNING

AMM

OBEY ALL THE AMM SAFETY PROCEDURES

WARNING

DO NOT TOUCH THE APU UNTIL IT IS SUFFICIENTLY COOL

WARNING

USE THE CORRECT PERSONAL PROTECTION

FUEL

OIL

WARNING

WHEN OPERATING THE APU WITH APU ACCESS DOORS OPEN, MAKE SURE THAT CORRECT FIRE EXTINGUISHING EQUIPMENT IS AVAILABLE

SAFETY PRECAUTIONS

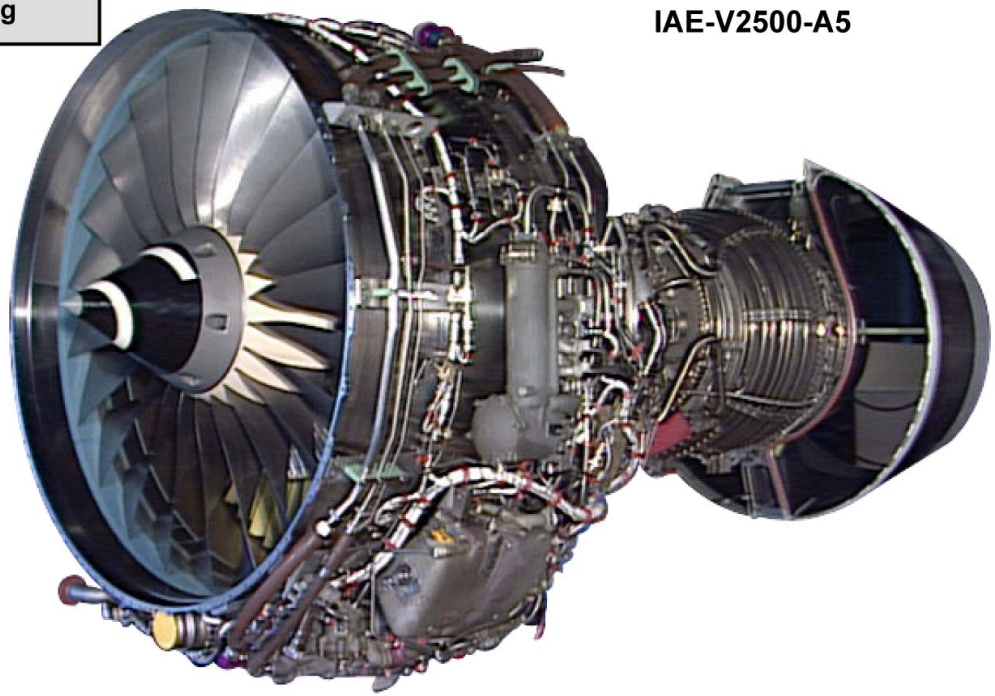
70 POWER PLANT IAE V2500 PRESENTATION (1)

INTRODUCTION

The IAE V2500-A5 engine is a two spool, axial flow, high bypass ratio turbo fan power engine. The V2500-A5 powers the complete single aisle family of aircraft except the A318. V2500-A5 engines are available in several thrust ratings.
All the engines are basically the same. A programming plug on the Electronic Engine Control (EEC) changes the available thrust.

A/C	ENGINE	THRUST (lbs)	THRUST (kg)
A319	V2522-A5 V2524-A5	22,000 lbs 24,000 lbs	9,980 kg 10,890 kg
A319CJ	V2527M-A5	27,000 lbs	12,250 kg
A320	V2527-A5 V2527E-A5	27,000 lbs	12,250 kg (Enhanced-high altitude perfomance)
A321	V2530-A5 V2533-A5	30,000 lbs 33,000 lbs	13,600 kg 14,980 kg

IAE-V2500-A5

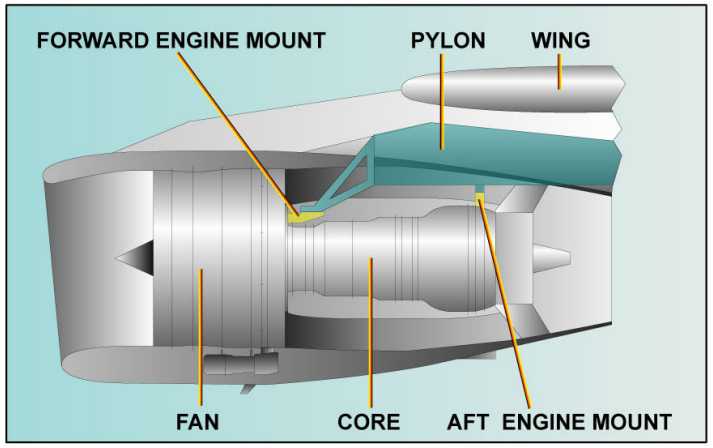


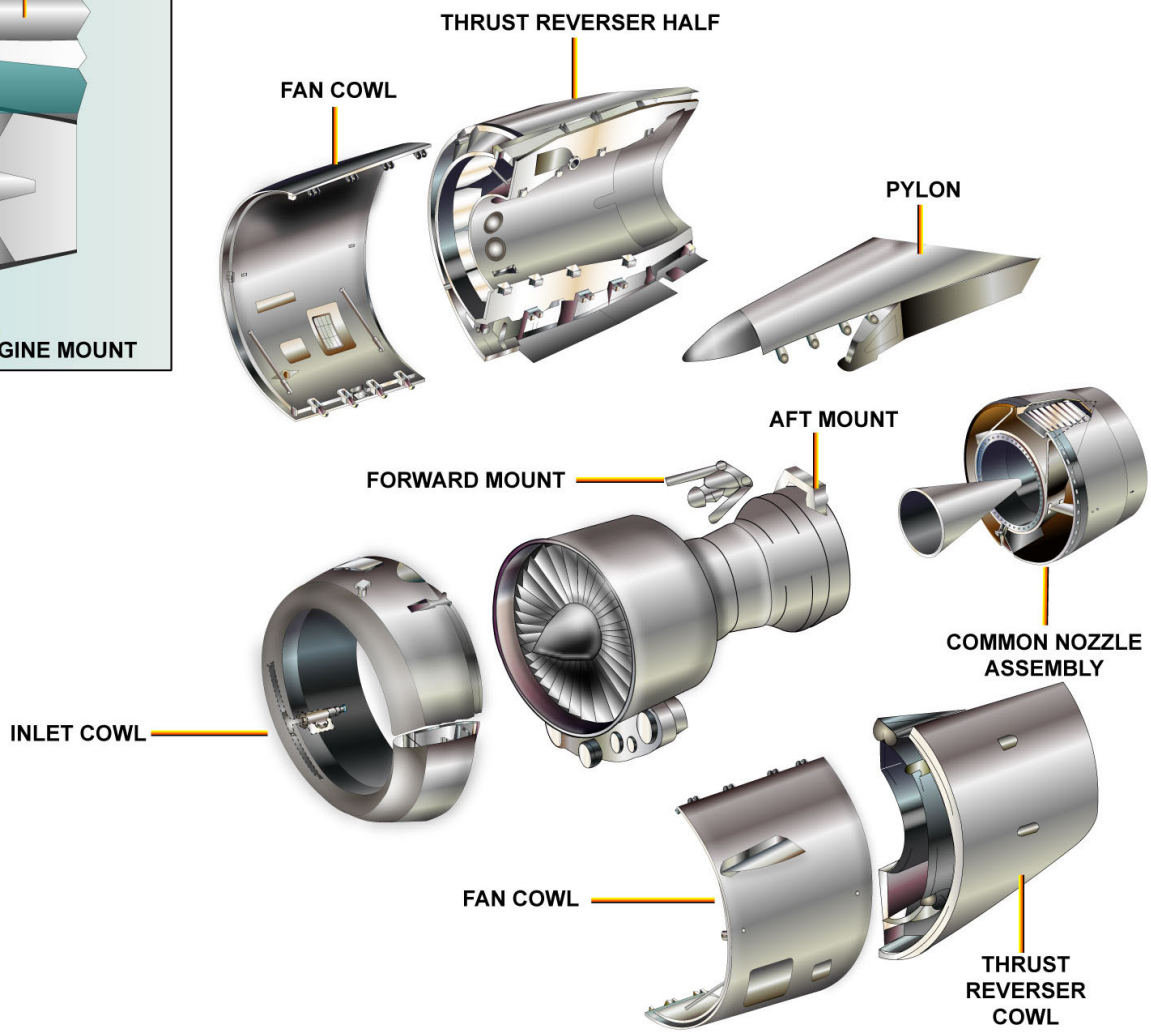
INTRODUCTION

70 POWER PLANT IAE V2500 PRESENTATION (1)

INSTALLATION

The power plant installation includes the engine, the engine inlet, the exhaust, the fan cowls and the reverser assemblies. The pylon connects the engine to the wing structure. The engine is attached to the pylon by FWD and AFT mounts.



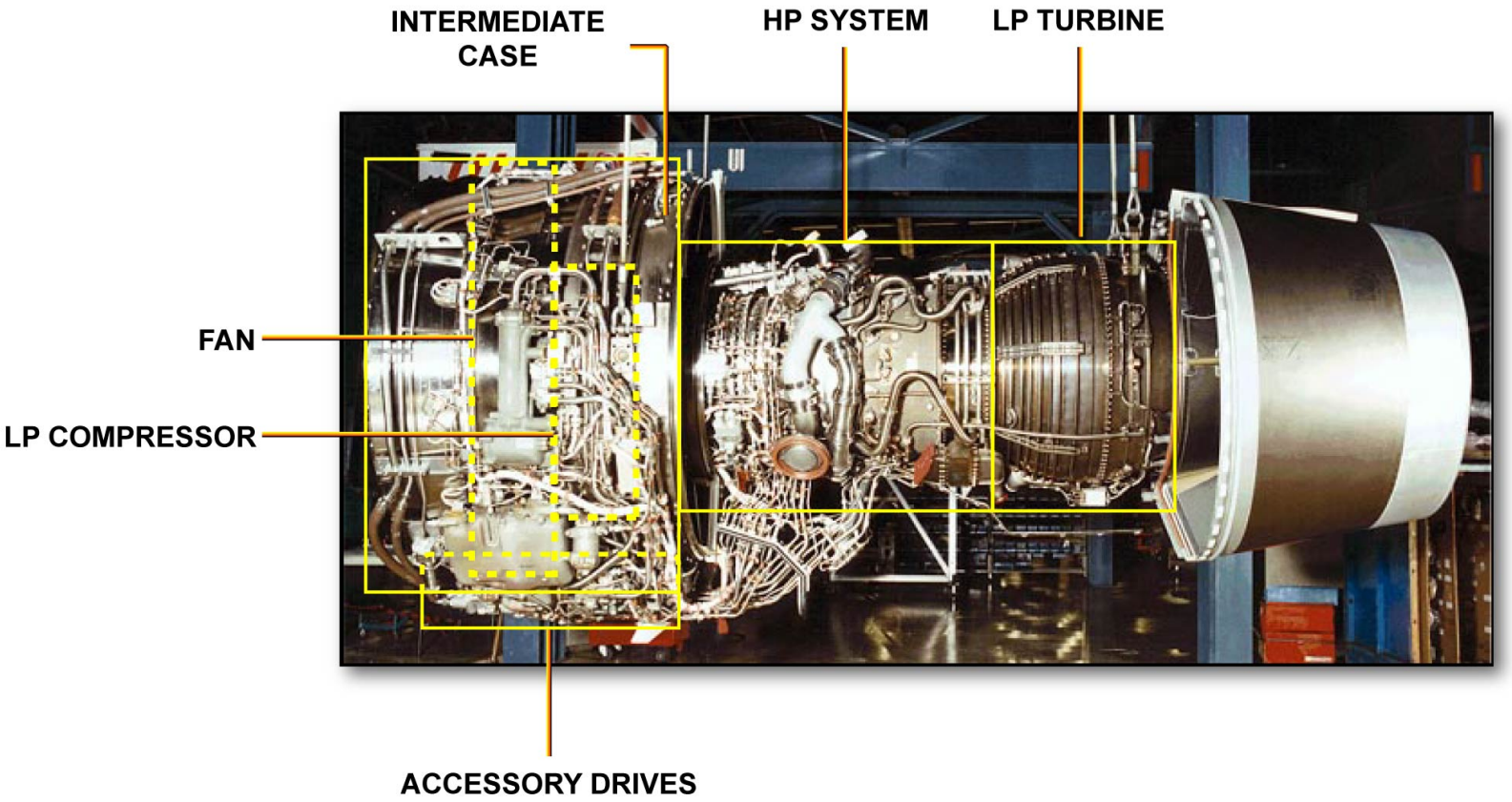


INSTALLATION

70 POWER PLANT IAE V2500 PRESENTATION (1)

MODULAR CONCEPT

The V2500-A5 is designed using a modular concept. For easy maintenance and quicker return-to-service, the engine is made of 5 primary modules:
- Fan,
- Low Pressure (LP) compressor and intermediate case,
- High Pressure (HP) system,
- LP turbine,
- Accessory drives.



MODULAR CONCEPT

70 POWER PLANT IAE V2500 PRESENTATION (1)

MODULAR CONCEPT (continued)

LP ROTOR

The LP rotor has the forward fan, the booster compressor and the LP shaft, all driven by the LP turbine. The speed of the LP rotor is indicated on ECAM as N1.
The fan assembly has 22 wide-chord blades and supplies most of the engine thrust. The air produced by the fan is known as secondary airflow or bypass airflow.
The intermediate case is the main structural support for the front of the engine. To protect the fuselage in case of a fan failure, it is designed to contain any broken blades. The 4-stage booster compressor is enclosed in the intermediate case. The booster supplies air to the engine core. This is primary airflow. The LP rotor (N1) is made of the fan and the booster compressor driven by the LP turbine.
Open the cowls to gain access to the forward engine mount.
The five-stage LP Turbine extracts energy from the gas stream delivered from the HP Turbine in order to drive the booster compressor and the fan. Exhaust gas from the LP turbine goes through a nozzle to supply propulsive thrust.
The LP rotor is supported by roller and ball bearings, which are lubricated and cooled.
The turbine exhaust case is the main structural support for the rear of the engine. The AFT mount is attached to the top of the turbine exhaust case.

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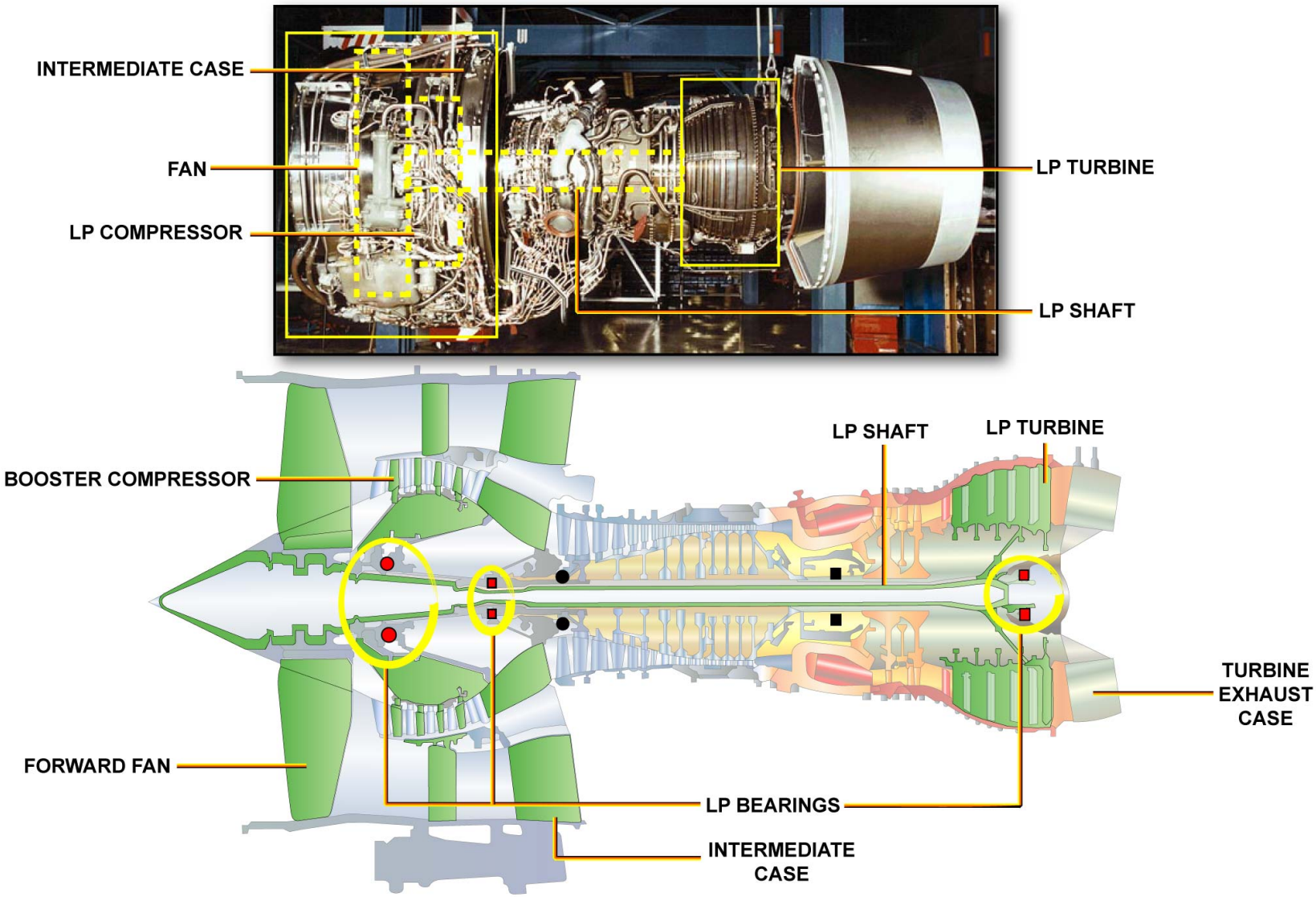


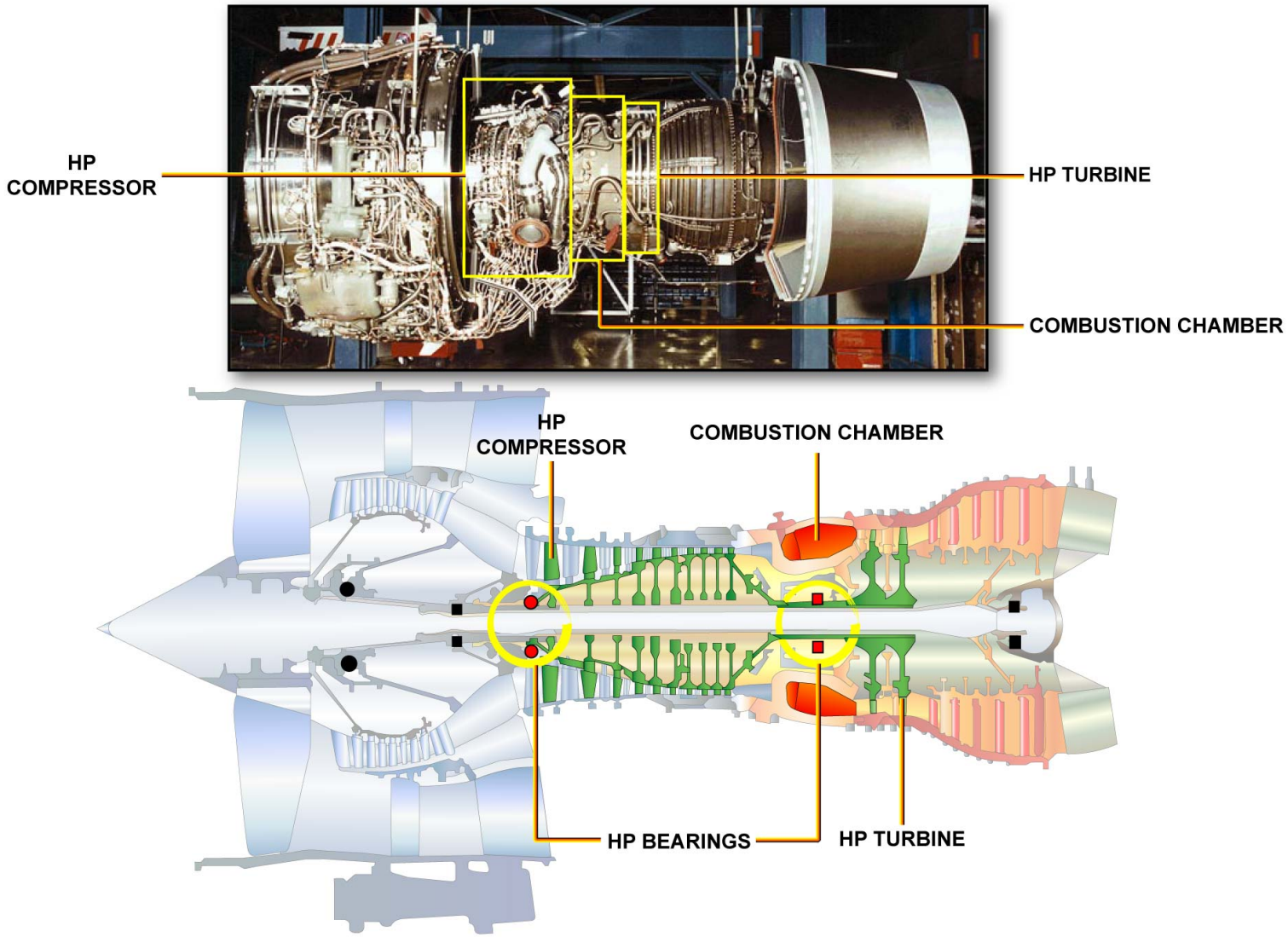
MODULAR CONCEPT - LP ROTOR

70 POWER PLANT IAE V2500 PRESENTATION (1)

MODULAR CONCEPT (continued)

HP ROTOR AND COMBUSTION CHAMBER

The HP rotor is made of a 10-stage HP compressor driven by a 2-stage HP turbine. The speed of the HP rotor is indicated on the ECAM as N2.
The HP compressor is also the source of customer bleed air.
The HP rotor is supported by roller and ball bearings, which are lubricated and cooled.
The annular combustion chamber is between the HP compressor and HP turbine. It has ports for 20 fuel nozzles and 2 igniter plugs.



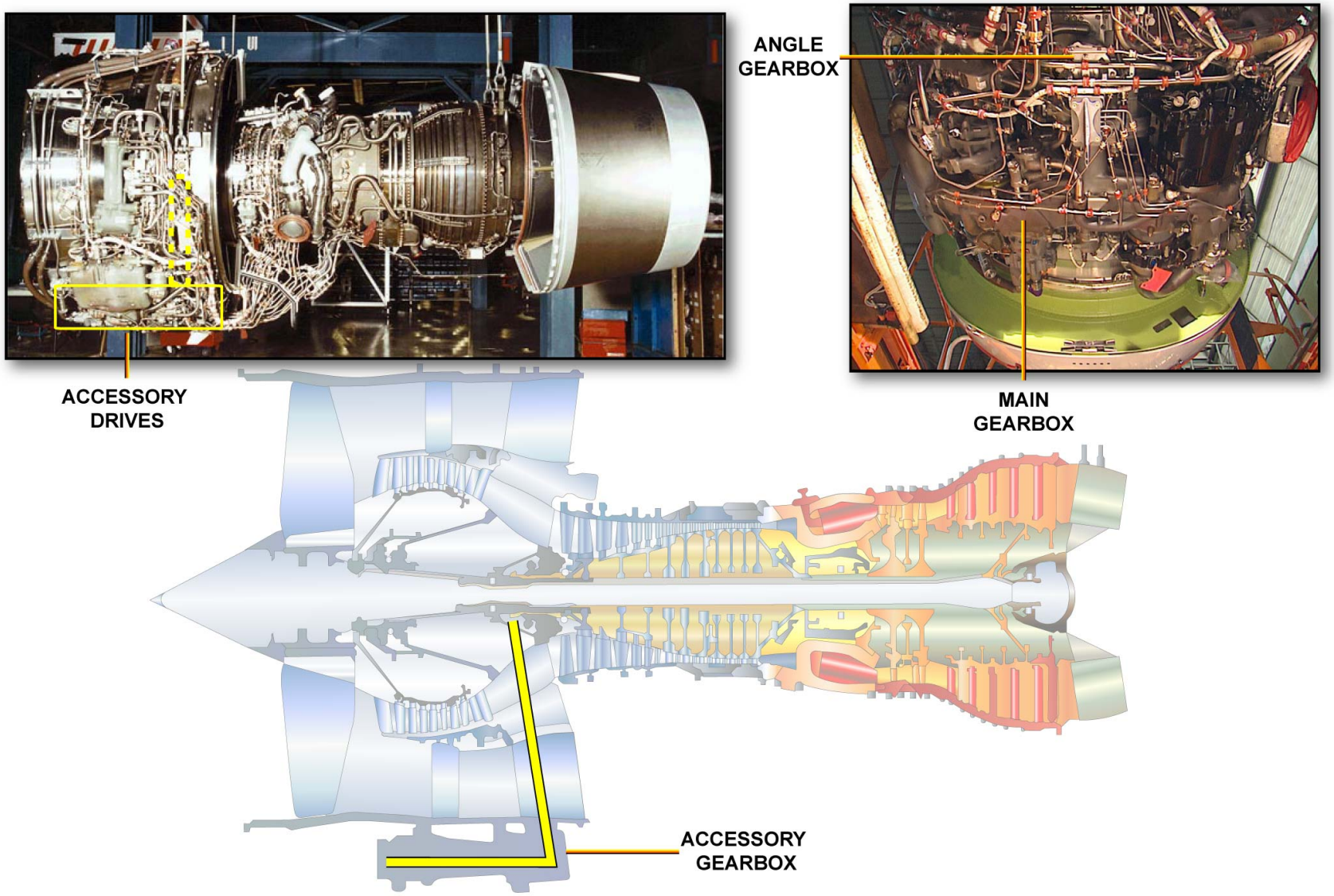
MODULAR CONCEPT - HP ROTOR AND COMBUSTION CHAMBER

70 POWER PLANT IAE V2500 PRESENTATION (1)

MODULAR CONCEPT (continued)

ACCESSORY GEARBOX

The accessory gearbox, installed at the bottom of the fan case, is driven by the HP rotor through the Angle gearbox. The fuel pumps, oil pumps, hydraulic pump, Integrated Drive Generator (IDG) and dedicated alternator are all driven by the gearbox.
During engine starting, the starter rotates the HP compressor through the gearboxes.

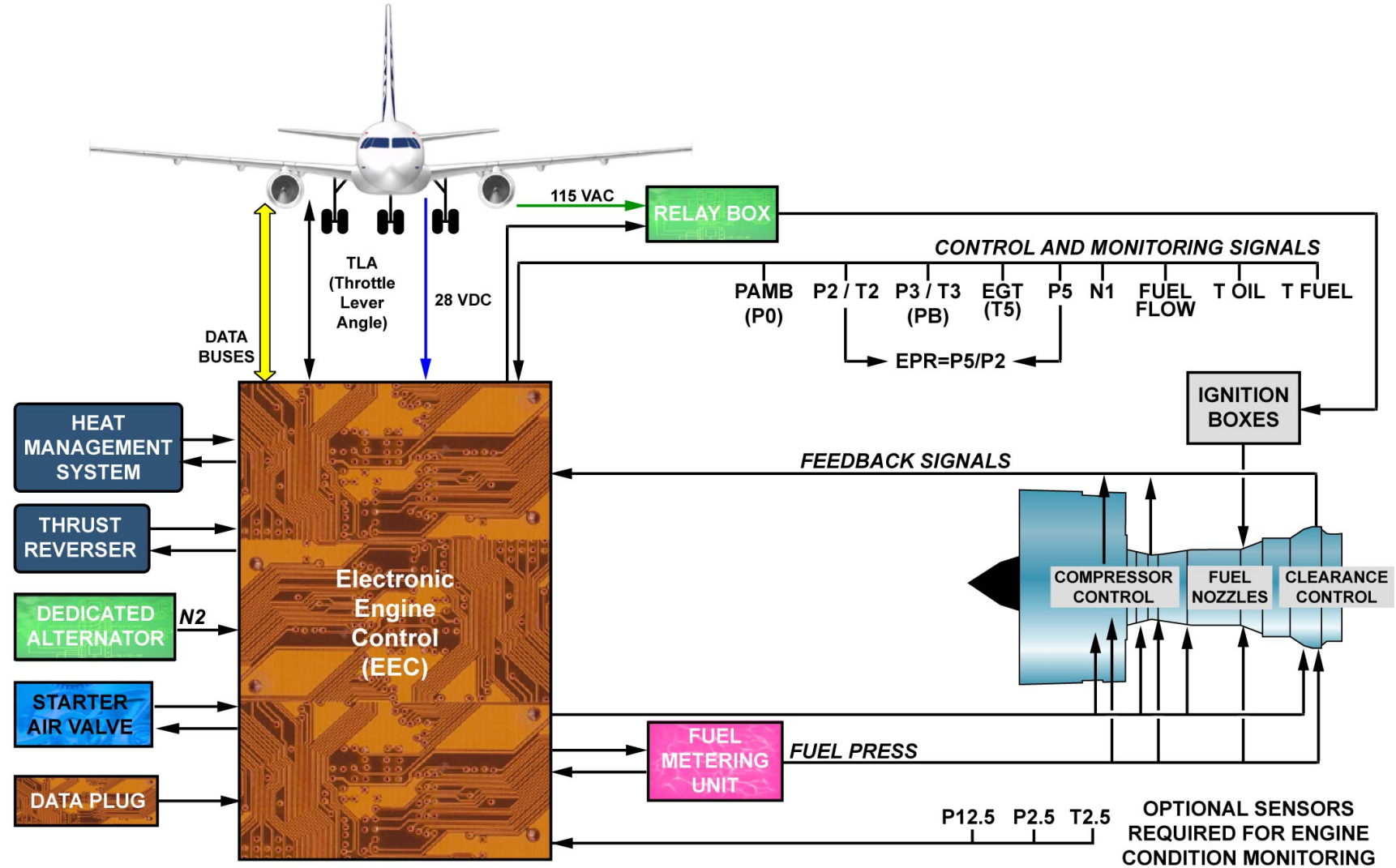


MODULAR CONCEPT - ACCESSORY GEARBOX

70 POWER PLANT IAE V2500 PRESENTATION (1)

FADEC

In order to increase engine reliability and efficiency, the Full Authority Digital Engine Control (FADEC) gives the full range of engine control to achieve steady state and transient engine performances when operated in combination with aircraft subsystems.
Each engine is controlled by an EEC. The EEC is a dual channel computer. The EEC controls the engine during start and all operations. The EEC manages engine thrust and protects against overspeed and overtemperature by controlling the engine sub-systems. The EEC also monitors all engine subsystems and sensors for failure. When the engine is running, power for FADEC operation is fulfilled by a dual-output FADEC alternator driven by the gearbox.
The FADEC system has the dual channel EEC and the following peripherals:
- Fuel Metering Unit (FMU),
- Dedicated FADEC alternator,
- Compressor control systems,
- Clearance control systems,
- Start system (starter shutoff valve, ignition exciters),
- Thrust reverser system,
- Heat management system,
- Engine sensors,
- Electrical harnesses.

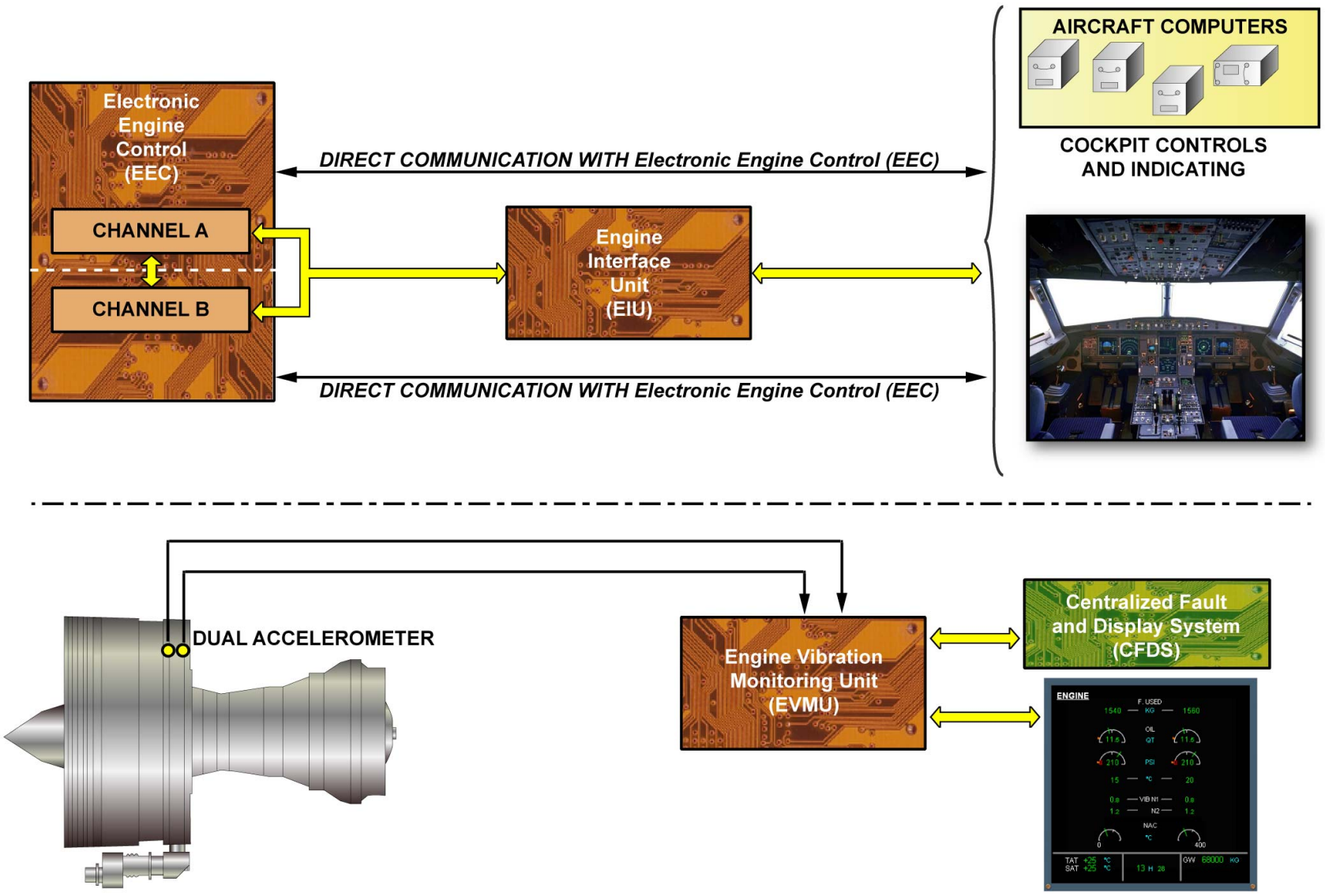

115 VAC
RELAY BOX
CONTROL AND MONITORING SIGNALS
PAMB (P0)
P2 / T2
P3 / T3 (PB)
EGT (T5)
P5
N1
FUEL FLOW
T OIL
T FUEL
EPR=P5/P2
TLA (Throttle Lever Angle)
28 VDC
DATA BUSES
IGNITION BOXES
FEEDBACK SIGNALS
HEAT MANAGEMENT SYSTEM
THRUST REVERSER
DEDICATED ALTERNATOR
N2
STARTER AIR VALVE
DATA PLUG
Electronic Engine Control (EEC)
COMPRESSOR CONTROL
FUEL NOZZLES
CLEARANCE CONTROL
FUEL METERING UNIT
FUEL PRESS
P12.5
P2.5
T2.5
OPTIONAL SENSORS REQUIRED FOR ENGINE CONDITION MONITORING

FADEC

70 POWER PLANT IAE V2500 PRESENTATION (1)

EIU/EVMU

The EEC interfaces with various aircraft systems. Essential communication with the EEC (thrust lever position, air data, etc.) is direct from the applicable systems and controls. Non-essential communication (autothrust, Centralized Fault Display System (CFDS), etc.) is routed through the Engine Interface Unit (EIU) of each engine. The EIUs interface with various aircraft circuits and systems. The data is then transmitted in a single stream to each EEC channel.
Engine vibration monitoring is accomplished by the Engine Vibration Monitoring Unit (EVMU). The EVMU collects vibration data from both engines. The vibration information is displayed on the ECAM and is also available through the CFDS for troubleshooting.

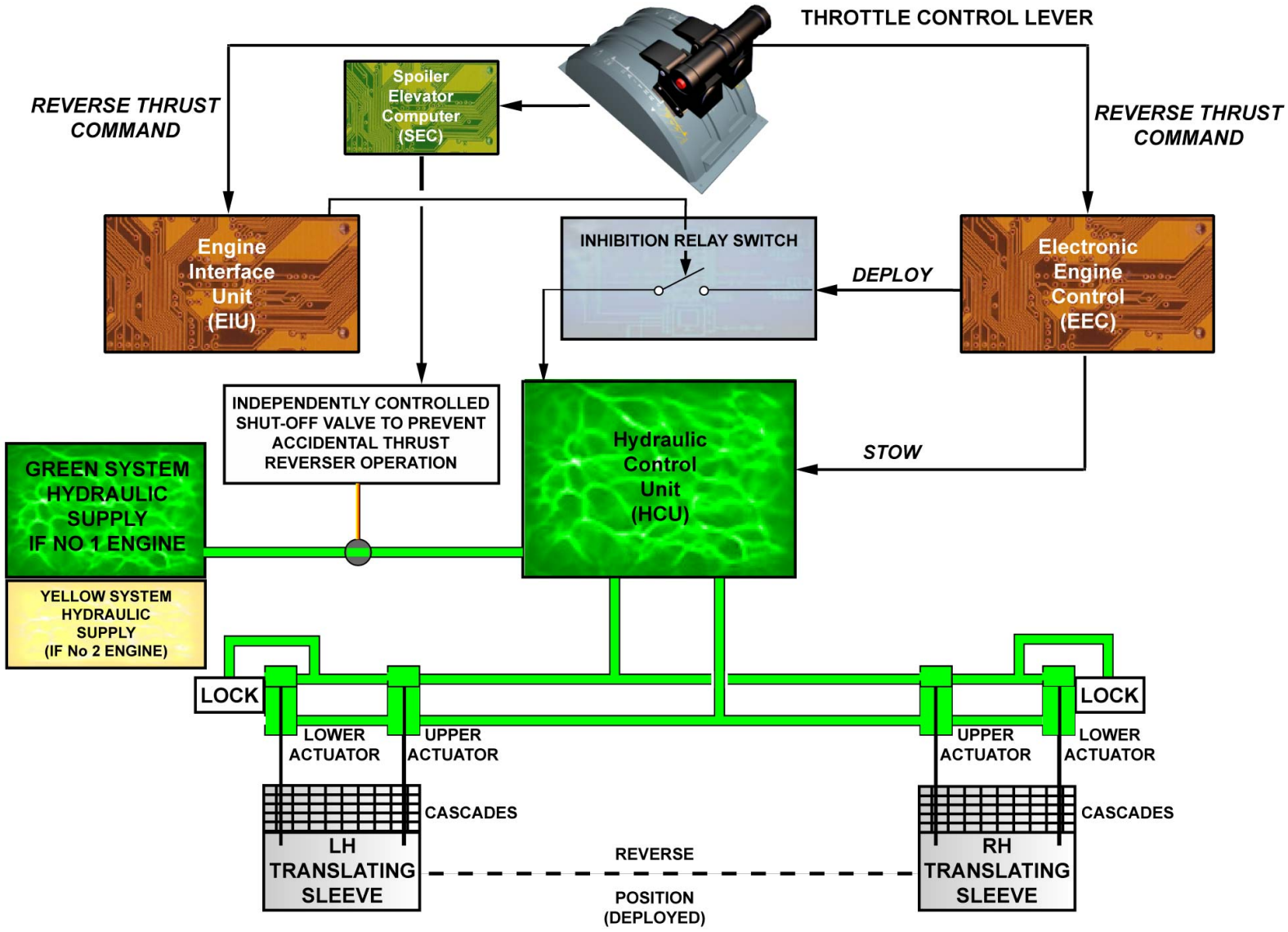

AIRCRAFT COMPUTERS
COCKPIT CONTROLS AND INDICATING
Electronic Engine Control (EEC)
CHANNEL A
CHANNEL B
DIRECT COMMUNICATION WITH Electronic Engine Control (EEC)
Engine Interface Unit (EIU)
DIRECT COMMUNICATION WITH Electronic Engine Control (EEC)
DUAL ACCELEROMETER
Engine Vibration Monitoring Unit (EVMU)
Centralized Fault and Display System (CFDS)
ENGINE

EIU/EVMU

70 POWER PLANT IAE V2500 PRESENTATION (1)

THRUST REVERSER SYSTEM

Reverse thrust is controlled by the EEC. Reverse is manually selected by the flight crew by lifting the latching levers on the throttle control levers. The reverse thrust command is sent to the EEC and the EIU. The DEPLOY command from the EEC is routed through the EIU as a second level of protection against inadvertent deployment.
According to commands from the EEC and the EIU, a Hydraulic Control Unit (HCU) supplies hydraulic power to operate the thrust reverser. The thrust reverser assembly has 2 hydraulically actuated translating sleeves. The translating sleeves are each powered by 2 actuators. As the translating sleeve moves aft during deployment, it raises blocker doors to redirect the engine fan airflow.
Reverse thrust is only available on the ground.



THRUST REVERSER SYSTEM

THRUST REVERSER STOWED
- TRANSLATING SLEEVES CLOSED -

THRUST REVERSER DEPLOYED
- TRANSLATING SLEEVES OPEN -

THRUST REVERSER SYSTEM

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70 POWER PLANT IAE V2500 PRESENTATION (1)

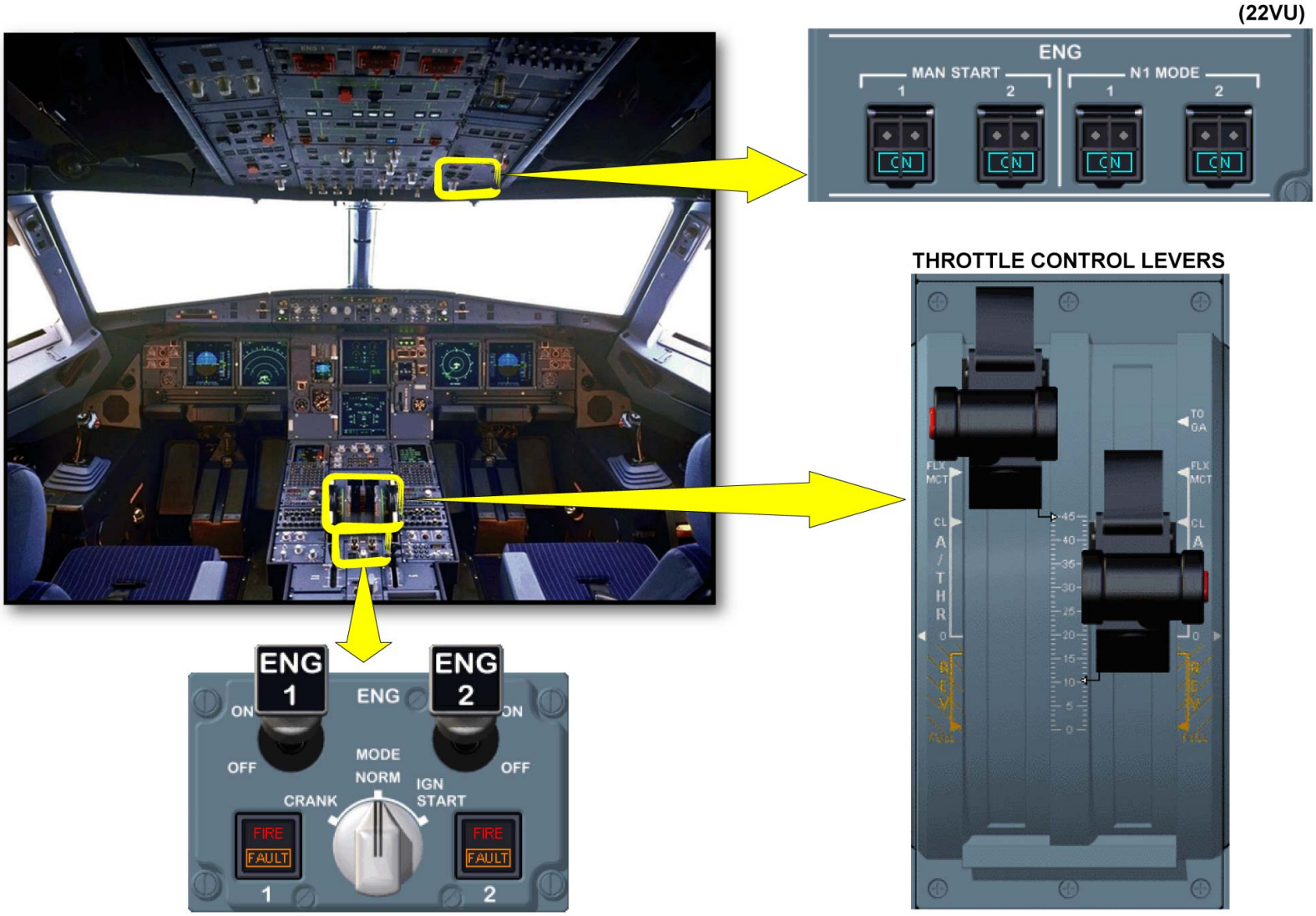
CONTROL AND INDICATING

This section will highlight the control panels and indications for the engines.

CONTROL PANELS

The engines are controlled by throttle control levers, on the center pedestal. They can only be moved manually.
For reverse thrust operation, two latching levers let the throttle control levers move rearward into the reverse thrust section.
The A320 family aircraft normally operate in autothrust mode in flight. The autothrust can be disconnected with the two red buttons known as instinctive disconnect pushbuttons (2 red buttons on the outside of each throttle control lever). This lets the engines be controlled in manual thrust mode.
The controls for engine starting and shutdown are on the center pedestal immediately behind the throttle control levers.
The engine MAN START switches are used to start an engine during a manual start procedure. They are also used during a dry or wet motoring procedure. The N1 MODE switches are used to change the engine control mode from Engine Pressure Ratio (EPR) to N1 control if an EPR failure occurs.

UGB13131 - U2AT4M0 - UM70PZ000000005



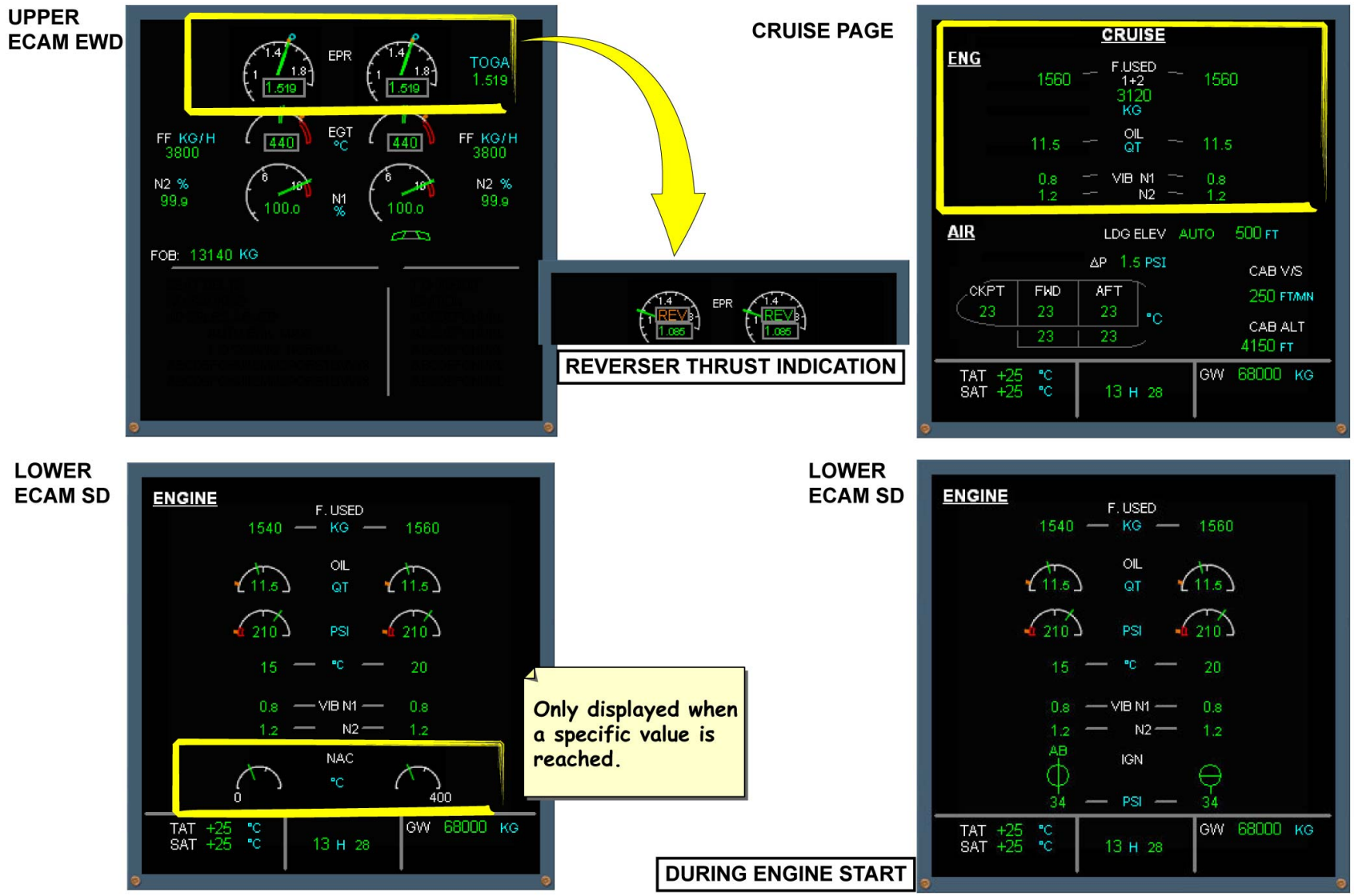
CONTROL AND INDICATING - CONTROL PANELS

70 POWER PLANT IAE V2500 PRESENTATION (1)

CONTROL AND INDICATING (continued)

ECAM ENGINE INDICATIONS

The engine primary parameters are permanently displayed on the upper ECAM.
The engine secondary parameters are either manually or automatically displayed on the lower ECAM.
Some engine parameters are permanently displayed on the CRUISE page in flight.

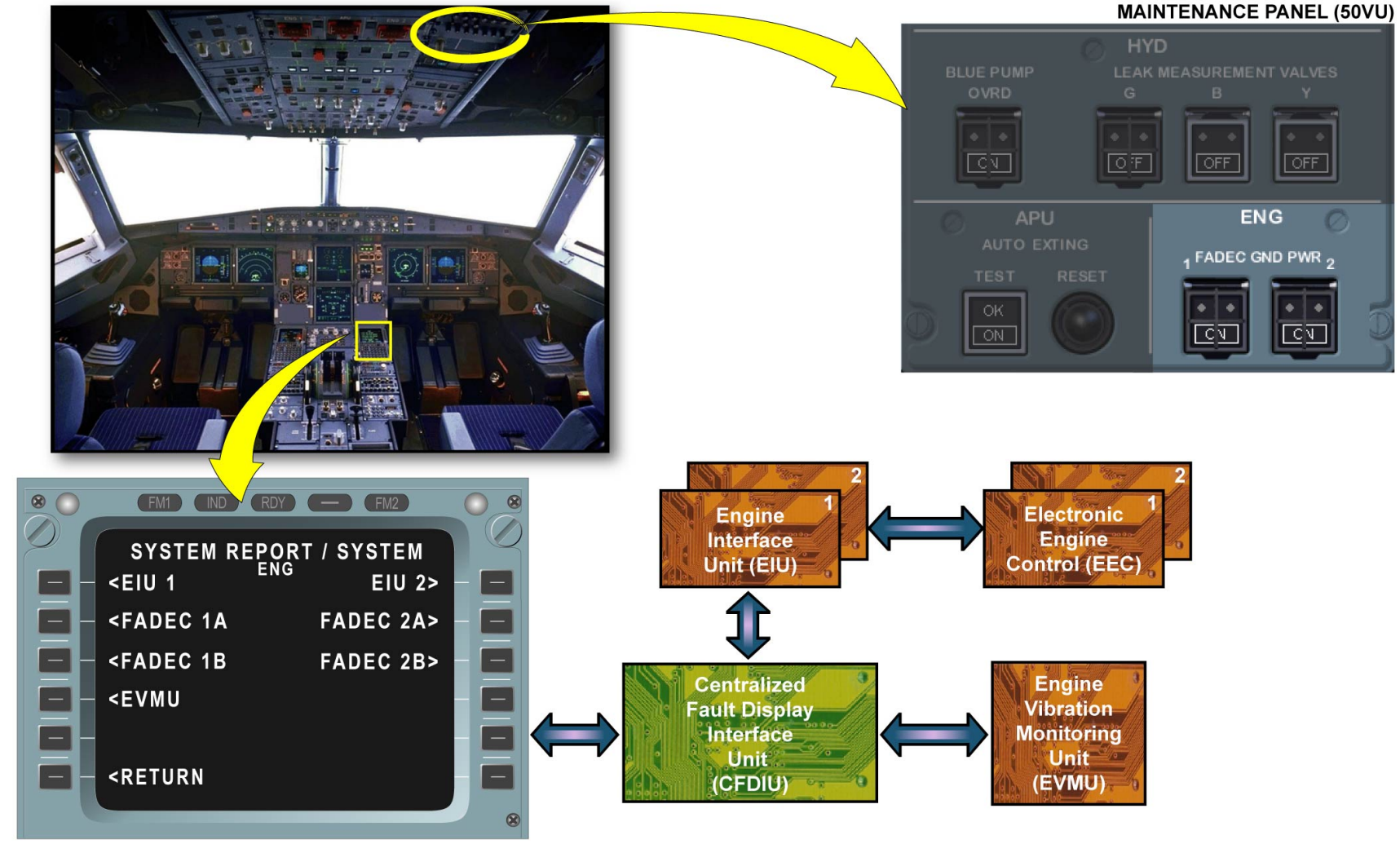


CONTROL AND INDICATING - ECAM ENGINE INDICATIONS

70 POWER PLANT IAE V2500 PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

On the maintenance panel, the ENG FADEC GND PWR is used to supply the computers dedicated to the engines for maintenance tasks, when the engines are not running.
The MCDU is used to do tests and troubleshooting monitored components (computers, sensors, actuators).

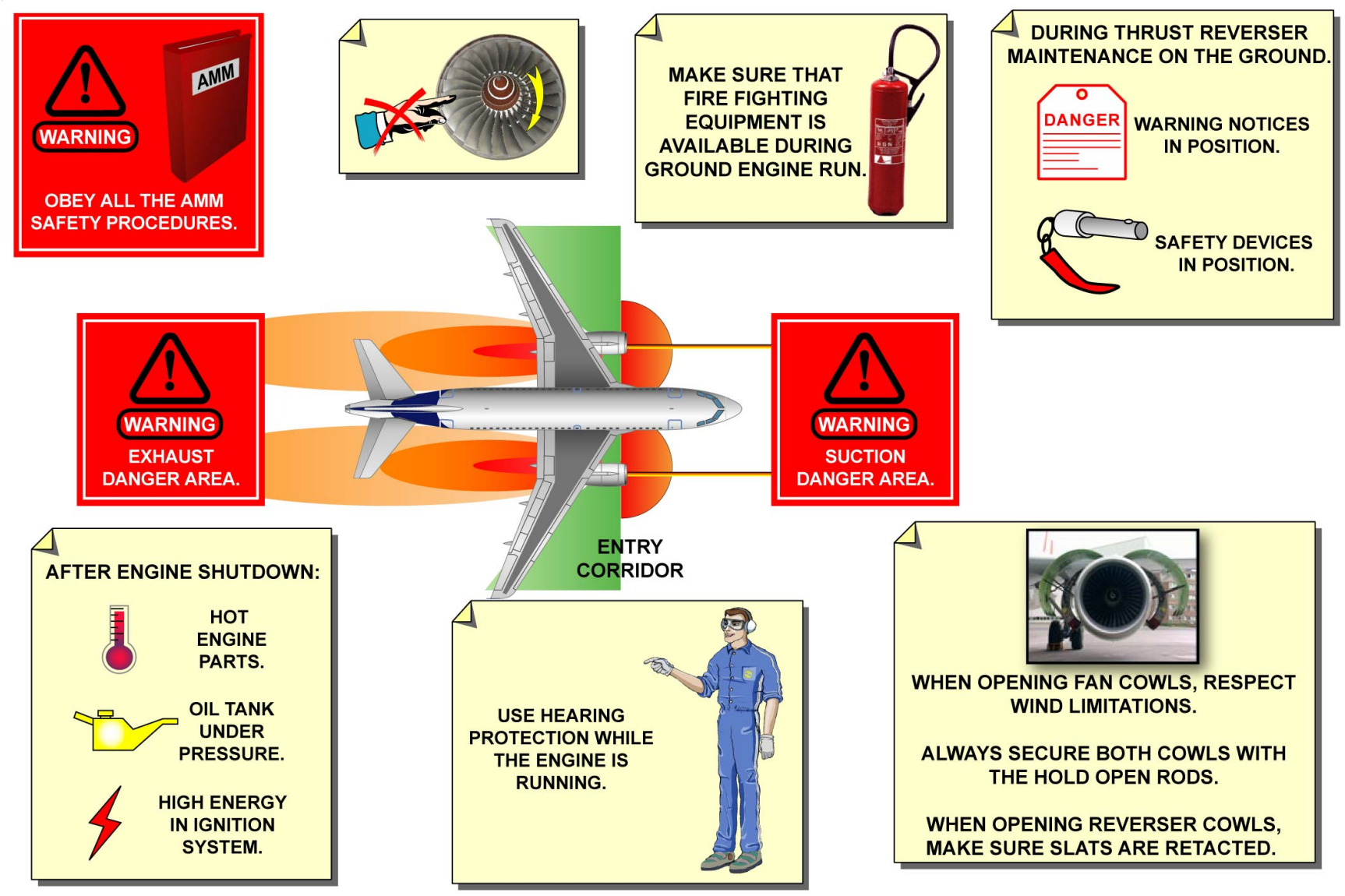


MAINTENANCE/TEST FACILITIES

70 POWER PLANT IAE V2500 PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on aircraft, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures.
This will prevent injury to persons and/or damage to aircraft. Here is an overview of main safety precautions related to the engines.
Make sure that all engine danger areas are as clear as possible to prevent damage to the engine, to the aircraft or to persons in the area.
Be careful: The entry corridor will be closed when the engine power is above the minimum.
Make sure that you have fire-fighting equipment available.
Do not try to stop the fan from turning by hand.
After engine shutdown, let the oil tank pressure bleed off a minimum of 5 minutes before you remove the tank filler cap. If you do not, pressurized oil can flow out of the tank and cause dangerous burns.
The engine ignition system is an electrical system with high energy. You must be careful to prevent electrical shock. Injury or death can occur. Do not do maintenance on the ignition system while the engine operates.
Make sure that the engine shutdown occurred more than 5 minutes ago before you continue with the maintenance procedure.
Make sure that the thrust reverser is deactivated during maintenance. If not, the thrust reverser can operate accidentally and cause injury to personnel and/or damage to the reverser.
When opening the engine cowls:
- Respect the wind limitations and the opening/closing sequence,
- Always secure cowls with the hold-open rods,
- Make sure that the slats are retracted and install a warning notice to prevent slat operation.


WARNING
AMM
OBEY ALL THE AMM SAFETY PROCEDURES.
MAKE SURE THAT FIRE FIGHTING EQUIPMENT IS AVAILABLE DURING GROUND ENGINE RUN.
DURING THRUST REVERSER MAINTENANCE ON THE GROUND.
DANGER
WARNING NOTICES IN POSITION.
SAFETY DEVICES IN POSITION.
WARNING
EXHAUST DANGER AREA.
WARNING
SUCTION DANGER AREA.
ENTRY CORRIDOR
AFTER ENGINE SHUTDOWN:
HOT ENGINE PARTS.
OIL TANK UNDER PRESSURE.
HIGH ENERGY IN IGNITION SYSTEM.
USE HEARING PROTECTION WHILE THE ENGINE IS RUNNING.
WHEN OPENING FAN COWLS, RESPECT WIND LIMITATIONS.
ALWAYS SECURE BOTH COWLS WITH THE HOLD OPEN RODS.
WHEN OPENING REVERSER COWLS, MAKE SURE SLATS ARE RETACTED.

SAFETY PRECAUTIONS

70 POWER PLANT IAE V2500 PRESENTATION (1)

LUBRICANTS AND FUELS

The list of the materials required for the aircraft service and maintenance can be found in the AMM, Chapter 20 STANDARD PRACTICES or Chapter 70 STANDARD PRACTICES for the engines.

AMM ATA 20 STANDARD PRACTICES
20-31-00 LIST OF MATERIALS

ITEM	DESIGNATION	SPECIFICATIONS
.	.	.
.	.	.
.	.	.
01-001	FUEL, TURBO	REF JET A-1
.	.	.
.	.	.

AMM ATA 70 STANDARD PRACTICES
70-30-00 (IAE) LIST OF MATERIALS

ITEM Nº	MATERIAL DESIGNATION	SPECIFICATIONS	CODE SUPPLIER
.	.	.	.
.	.	.	.
V10-077A	APPROVED ENGINE OIL	MOBIL JET II	19135 K1932
V10-077C	APPROVED ENGINE OIL	AEROSHELL 560	K1315 5427
V10-077C	APPROVED ENGINE OIL	BP TURBO OIL 2380	29700 K1274
.	.	.	.
.	.	.	.

LUBRICANTS AND FUELS

70 POWER PLANT IAE V2500 PRESENTATION (1)

STORAGE AND PRESERVATION

Storage and preservation procedures must be applied to engines, which are not operated. The preservation procedures protect the engine against corrosion, liquid and debris entering the engine, and atmospheric conditions during period of inactivity.

CAUTION: Under no circumstances shall preservative oil or equivalent be sprayed into the engine inlet, core compressor or turbine, or engine exhaust. Dirt particles deposited on the wet blades and vanes may adversely affect engine performance during subsequent operation.

UGB13131 - U2AT4M0 - UM70PZ00000005

STORAGE AND PRESERVATION PROCEDURES MUST BE APPLIED FOR ENGINES WHICH ARE NOT OPERATED.

PROTECTION AGAINST ATMOSPHERIC CONDITIONS

THE PRESERVATION PROCEDURES PROTECT THE ENGINE AGAINST CORROSION, LIQUID AND DEBRIS ENTERING THE ENGINE, AND ATMOSPHERIC CONDITIONS DURING PERIOD OF INACTIVITY.

CAUTION

UNDER NO CIRCUMSTANCES SHALL PRESERVATIVE OIL OR EQUIVALENT BE SPRAYED INTO THE ENGINE INLET, CORE COMPRESSOR OR TURBINE, OR ENGINE EXHAUST. DIRT PARTICLES DEPOSITED ON THE WET BLADES AND VANES MAY ADVERSELY AFFECT ENGINE PERFORMANCE DURING SUBSEQUENT OPERATION.

STORAGE AND PRESERVATION

36 PNEUMATIC SYSTEM PRESENTATION (1)

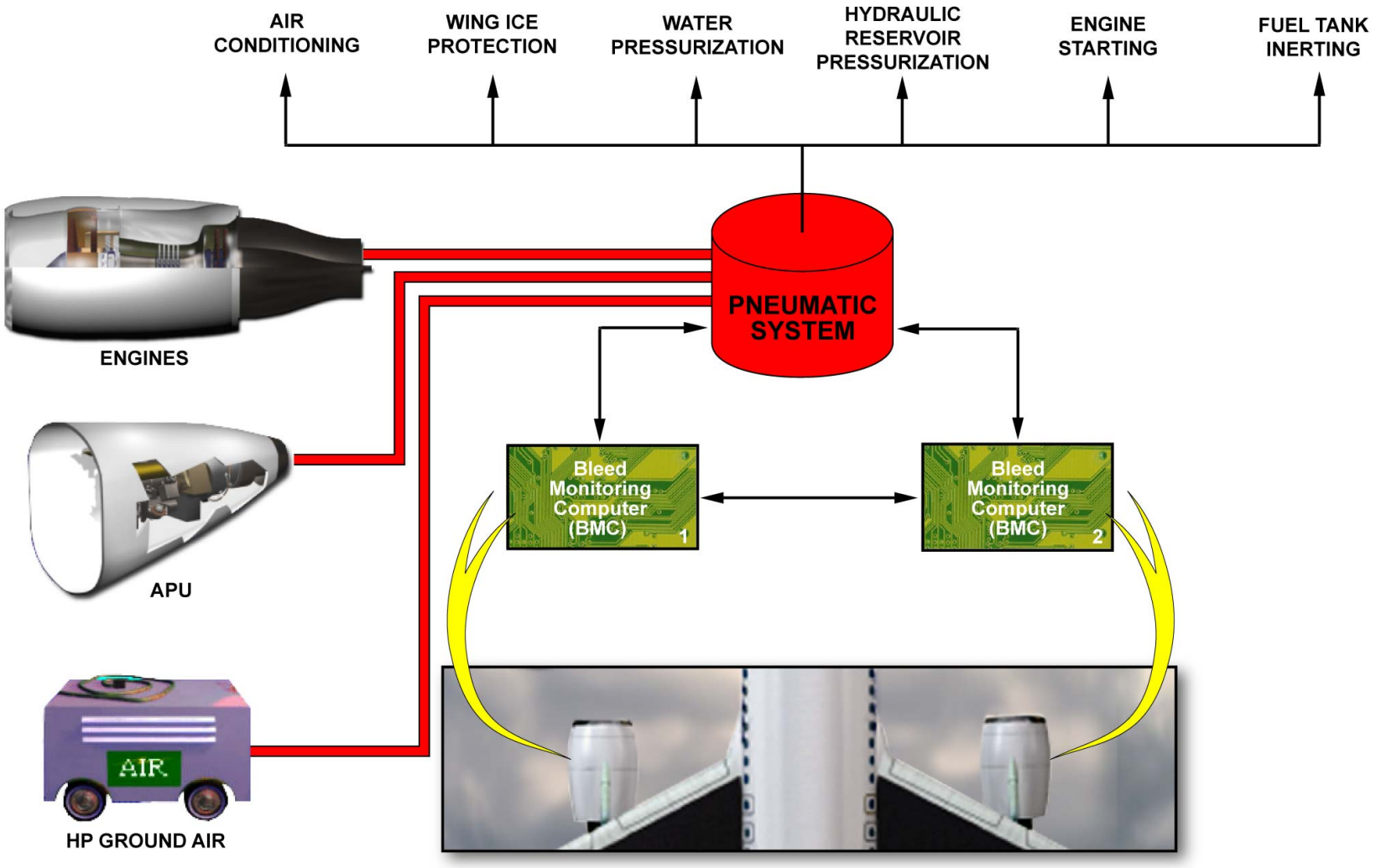
SYSTEM INTRODUCTION

The Airbus Single Aisle family pneumatic system supplies High Pressure (HP) air for:
- Air conditioning,
- Wing ice protection,
- Water pressurization,
- Hydraulic reservoir pressurization,
- Engine starting,
- Fuel tank inerting system.

High Pressure air can be supplied from three sources:
- The engine bleed system,
- The APU,
- A HP Ground Power Unit (GPU).

The pneumatic system operates pneumatically and is monitored by 2 Bleed Monitoring Computers (BMC 1 & 2).
There is one BMC for each engine bleed system.
Both BMCs exchange data. If one BMC fails, the other BMC takes over most of its monitoring functions.

UGB13131 - U2AT4M0 - UM36PZ00000002



SYSTEM INTRODUCTION

36 PNEUMATIC SYSTEM PRESENTATION (1)

SYSTEM INTRODUCTION (continued)

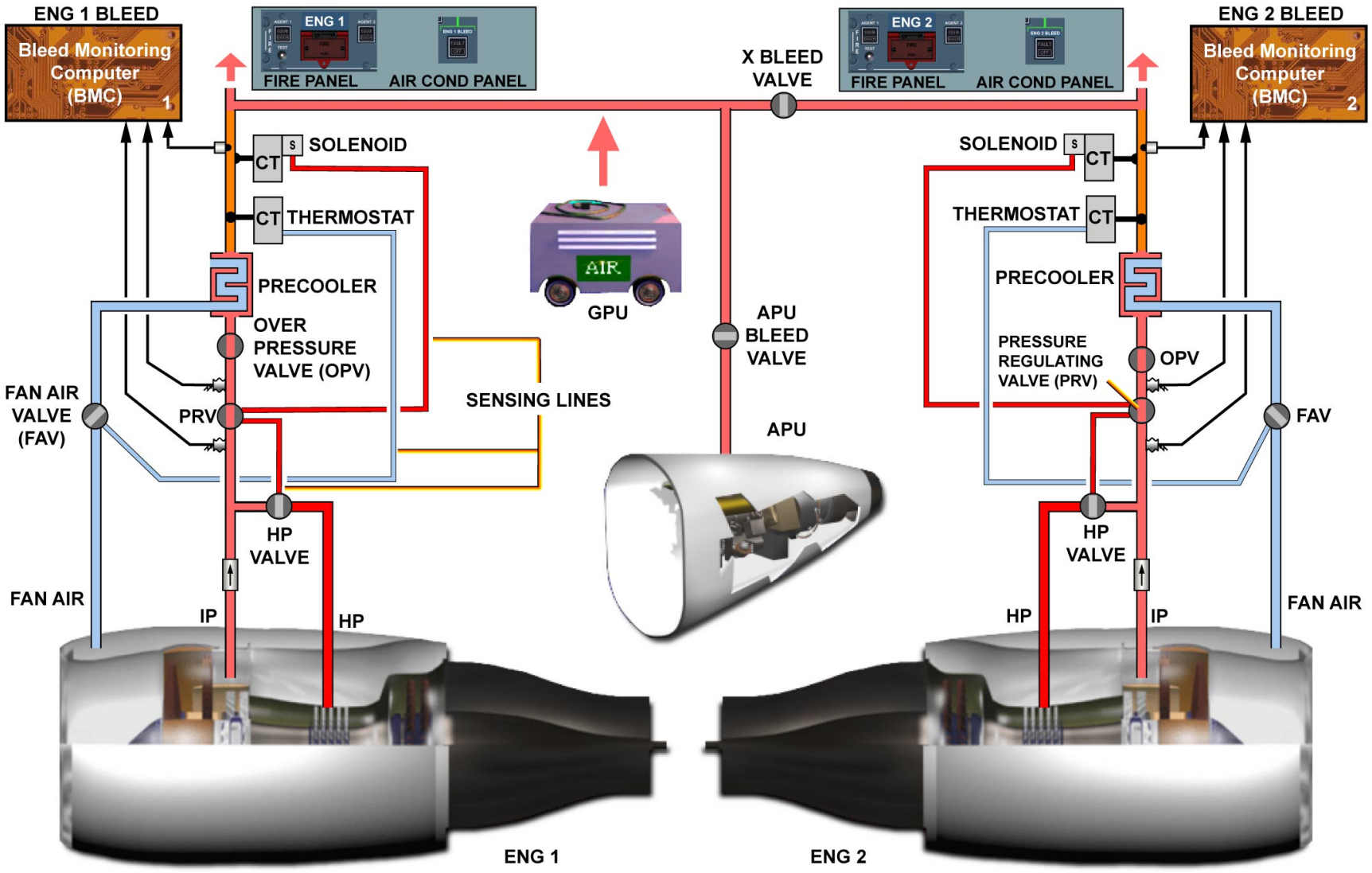
ENGINE BLEED

The engine bleed air is pressure and temperature regulated before it supplies the pneumatic system. Air is bled from the Intermediate Pressure (IP) stage or the HP stage with the High Pressure Valve (HPV) which is used for the pneumatic regulation. The IP check valve gives protection to the IP stage from reverse flow when the HP valve is open.
The HP bleed is only used when the engines are at low power and for engine efficiency the High Pressure Valve (HPV) is kept closed during cruise.
The Pressure Regulating Valve (PRV) is installed in the duct downstream of the IP and HP bleed valves, and it pneumatically regulates the downstream pressure. The PRV is used as a protective shut off valve when the parameters are incorrect.
The shut off protective function uses sensing lines connected to a Control Solenoid to close pneumatically the Pressure Regulating Valve (PRV) and the High Pressure Valve (HPV).
The control solenoid is wired to the BMC and to the Bleed section of the AIR COND and the FIRE panels in the cockpit.
An Overpressure Valve (OPV) is installed downstream of the bleed valve to give protection to the system if an overpressure condition occurs.
The Fan Air Valve (FAV) modulates Fan discharge air through an air-to-air heat exchanger called "precooler", to regulate the Bleed temperature.
The Fan Air Valve (FAV) regulated position is connected to the Control Thermostat (CT) (downstream of the precooler) via a sensing line.
The pneumatic system operates pneumatically and is monitored by two Bleed Monitoring Computers (BMC1 and BMC2).
Each BMC monitors its related Engine Bleed system. For this monitoring, the BMCs read two pressure transducers (upstream / downstream of the PRV) and the Precooler downstream temperature sensor.

APU BLEED/EXTERNAL AIR

The left and right bleed systems are connected by a crossbleed duct.
A crossbleed valve is used for their interconnection or isolation.
The APU can also be used for bleed air supply. This is usually done on the ground for air conditioning and for engine start.
But APU BLEED air can also be used in flight, in relation to altitude (the altitude is varied and limited by the manufacturer).
The APU bleed supply is connected to the left side of the crossbleed duct.
On the ground, a HP GPU can be connected to the left side pneumatic system. The crossbleed valve can be opened to supply the right side.

UGB13131 - U2AT4M0 - UM36PZ00000002



SYSTEM INTRODUCTION - ENGINE BLEED & APU BLEED/EXTERNAL AIR

36 PNEUMATIC SYSTEM PRESENTATION (1)

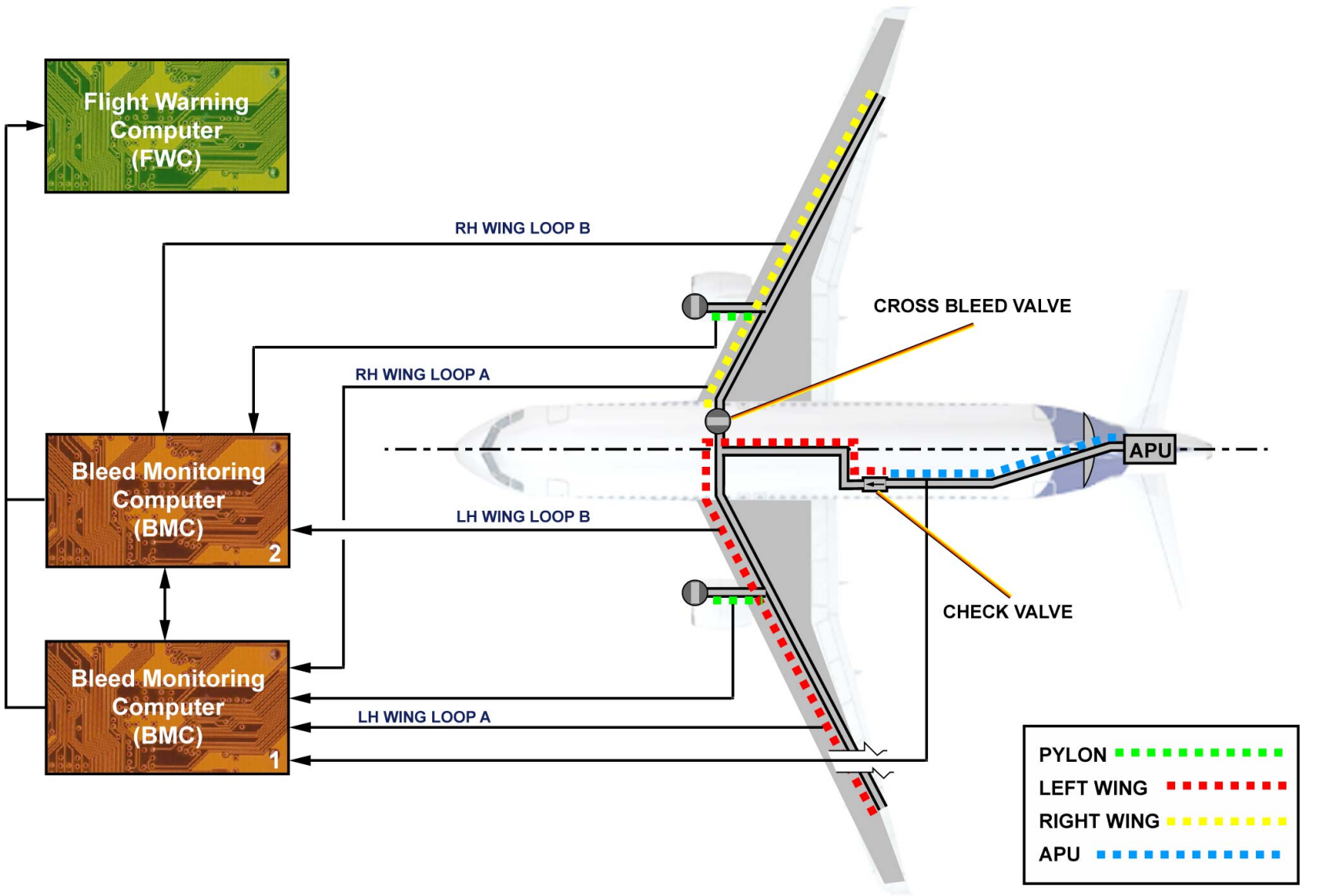
SYSTEM INTRODUCTION (continued)

LEAK DETECTION

Leak detection loops are installed along the hot air supply ducts of the pneumatic system. The loops are made of multiple sensing elements connected in series. The leak detection loops are connected to the BMCs. If a leak is detected, a signal is sent to the BMC 1 or 2 which automatically isolates the affected area by closing the crossbleed valve and shutting off the engine bleed on the affected side. The leak detection system is organized into three loops. Here are the loops and the protected areas: - Pylon: from the precooler to the wing leading edge,

- Wing: wing leading edge, including the wing air inlet supply, and belly fairing (cross bleed duct, pack supply ducts and APU forward supply duct).
- APU: APU aft supply duct (left hand side of the fuselage) from APU firewall to wheel well area.

UGB13131 - U2AT4M0 - UM36PZ00000002



SYSTEM INTRODUCTION - LEAK DETECTION

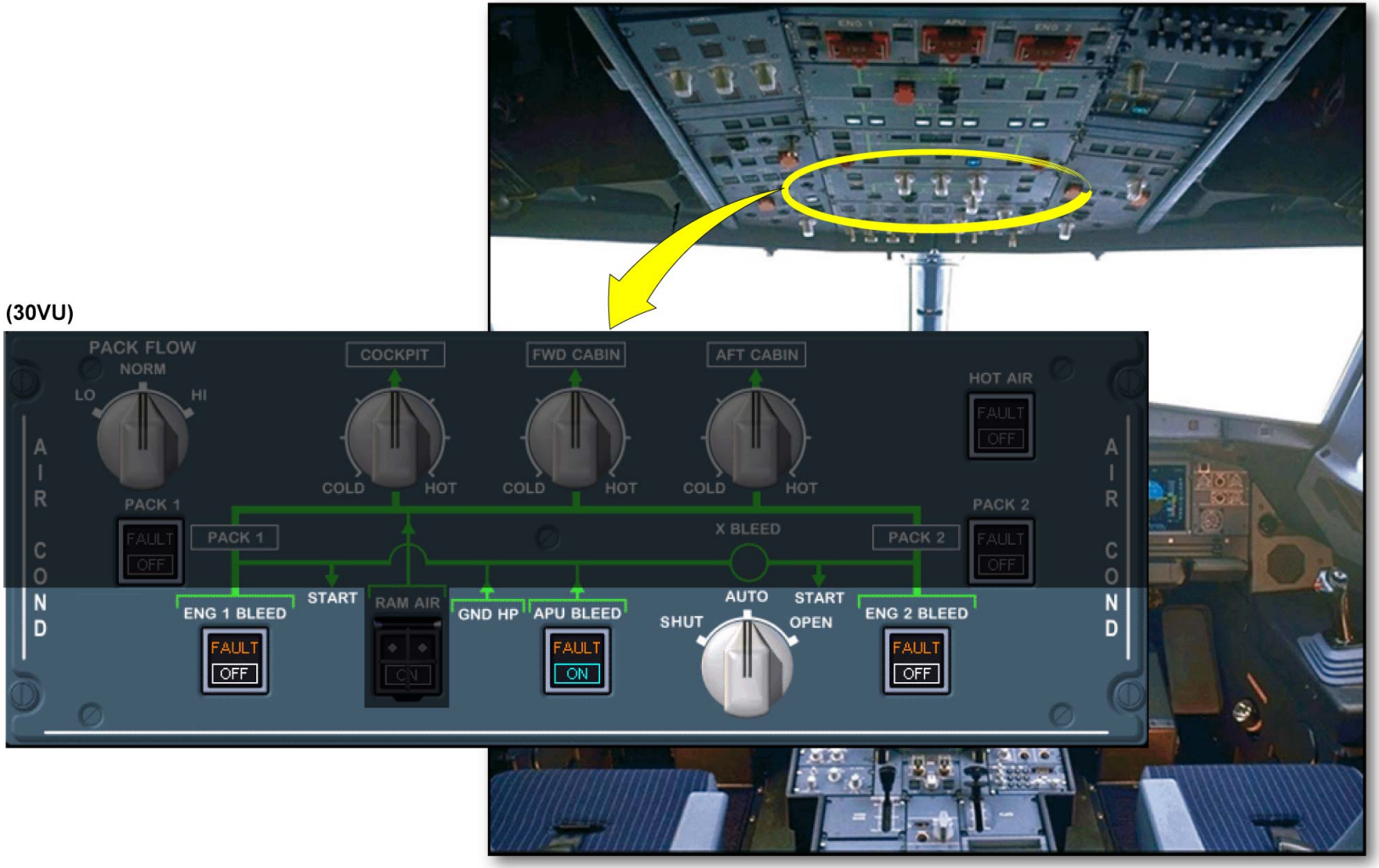
36 PNEUMATIC SYSTEM PRESENTATION (1)

CONTROL & INDICATING

This section is related to the control panels and indications for the pneumatic system.

CONTROL PANEL

Controls for the pneumatic system are part of the AIR COND panel and are operated from the overhead panel.



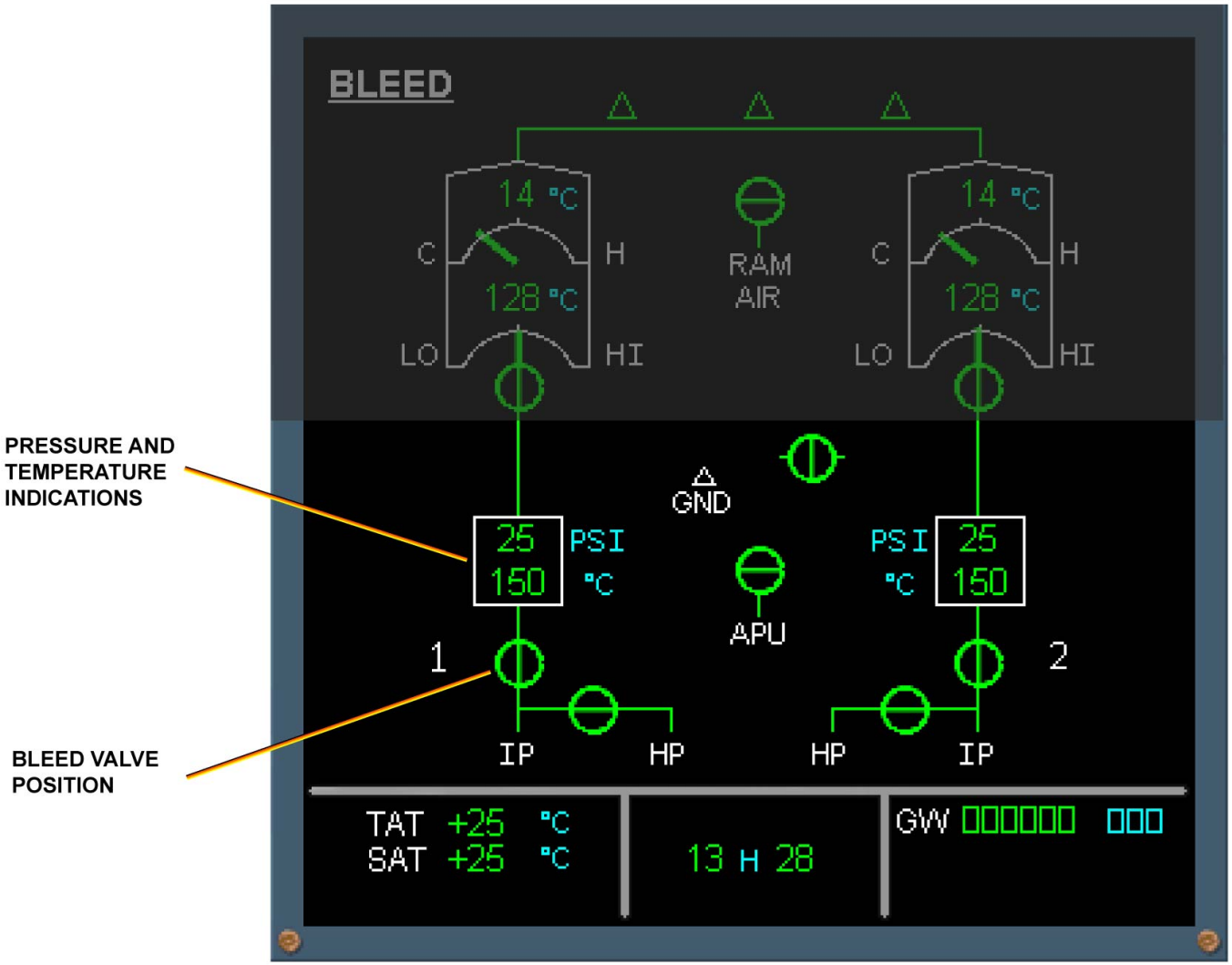
CONTROL & INDICATING - CONTROL PANEL

36 PNEUMATIC SYSTEM PRESENTATION (1)

CONTROL & INDICATING (continued)

ECAM INDICATION

The pneumatic system indications are displayed on the lower part of the ECAM BLEED page.



SD

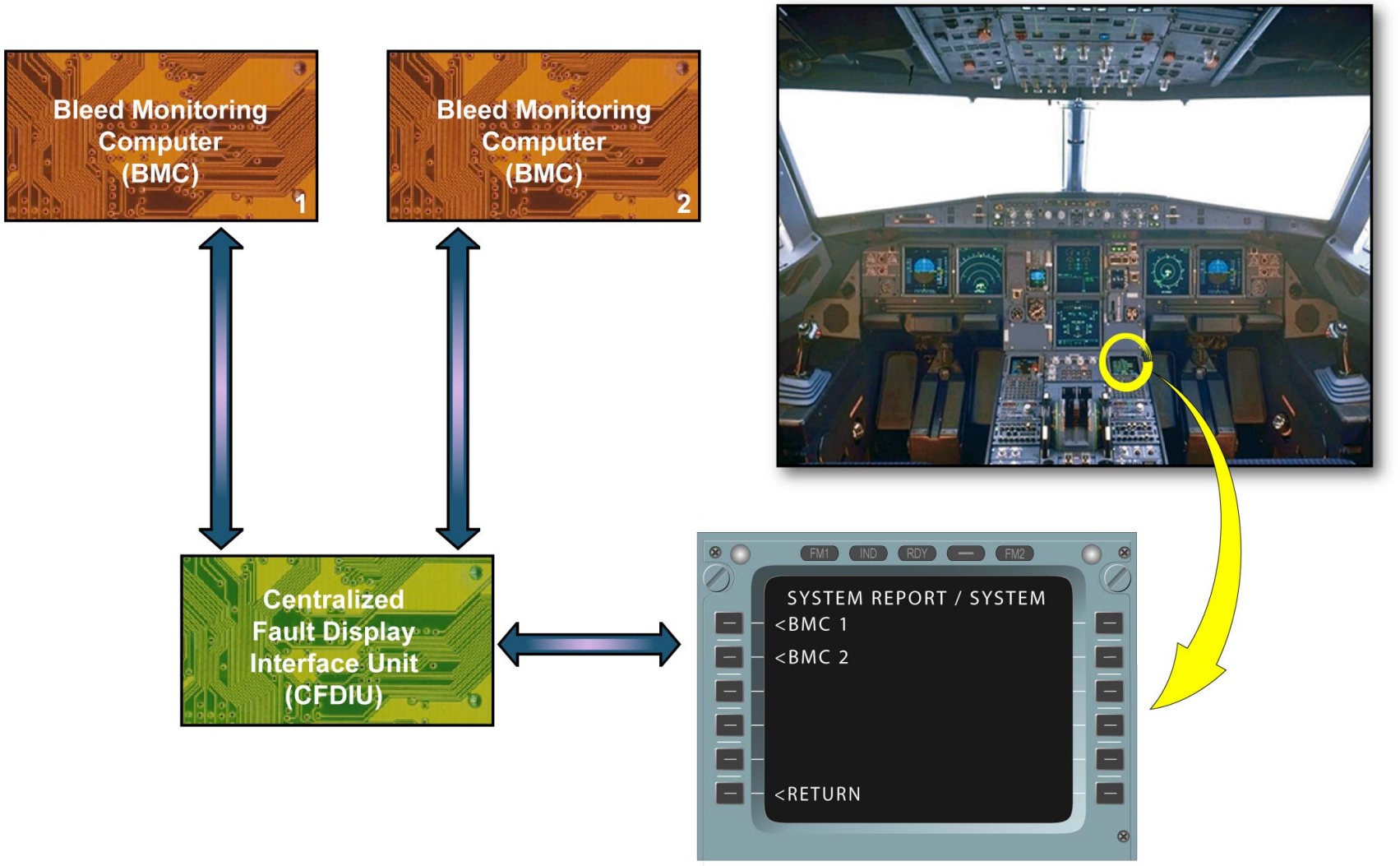
CONTROL & INDICATING - ECAM INDICATION

36 PNEUMATIC SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

Using the Multipurpose Control and Display Unit (MCDU), you can have access to the Centralized Fault Display System (CFDS) fault messages of the PNEUMATIC system. Specific BMC Built-In Test Equipment (BITE) is also available for BMC 1 and 2.

UGB13131 - U2AT4M0 - UM36PZ00000002



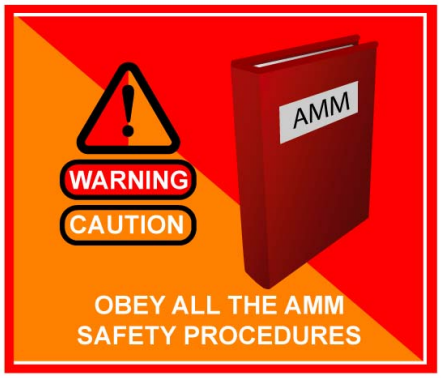
MAINTENANCE/TEST FACILITIES

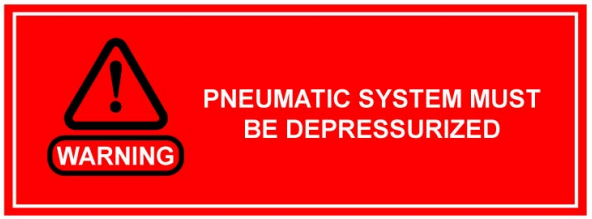
36 PNEUMATIC SYSTEM PRESENTATION (1)

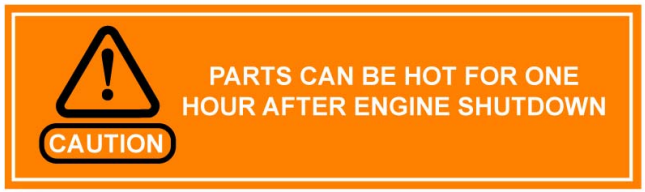
SAFETY PRECAUTIONS

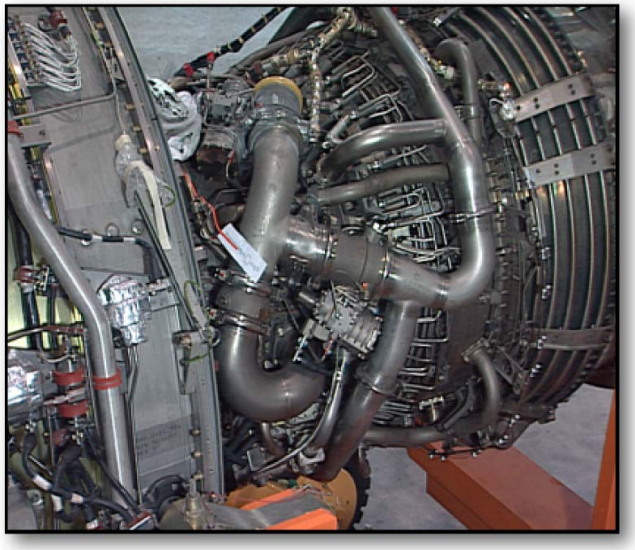
When you do work on the aircraft, make sure that you obey all the Aircraft Maintenance Manual (AMM) safety procedures. This will prevent injury to people and / or damage to the aircraft. Here is an overview of the main safety precautions related to the pneumatic system.
Make sure that the pneumatic system is depressurized before you start the work. HP air can cause unwanted pressurization of the aircraft, and injury to personnel.
Be careful when you do work on the engine components immediately after the engine shutdown. The engine components can stay hot for one hour.

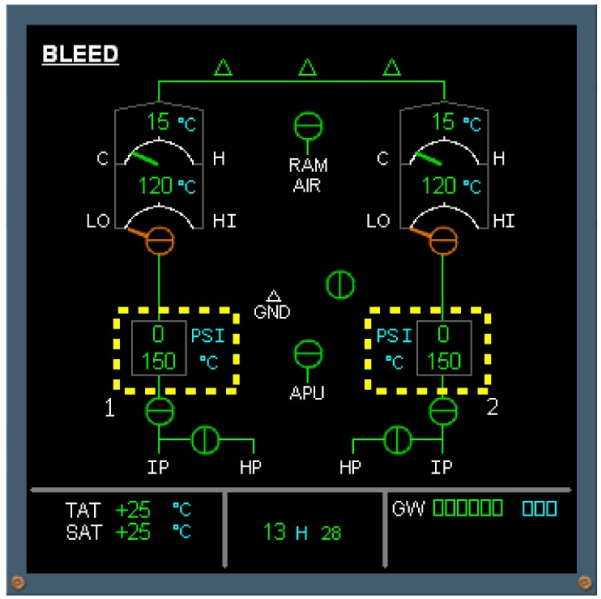
UGB13131 - U2AT4M0 - UM36PZ00000002











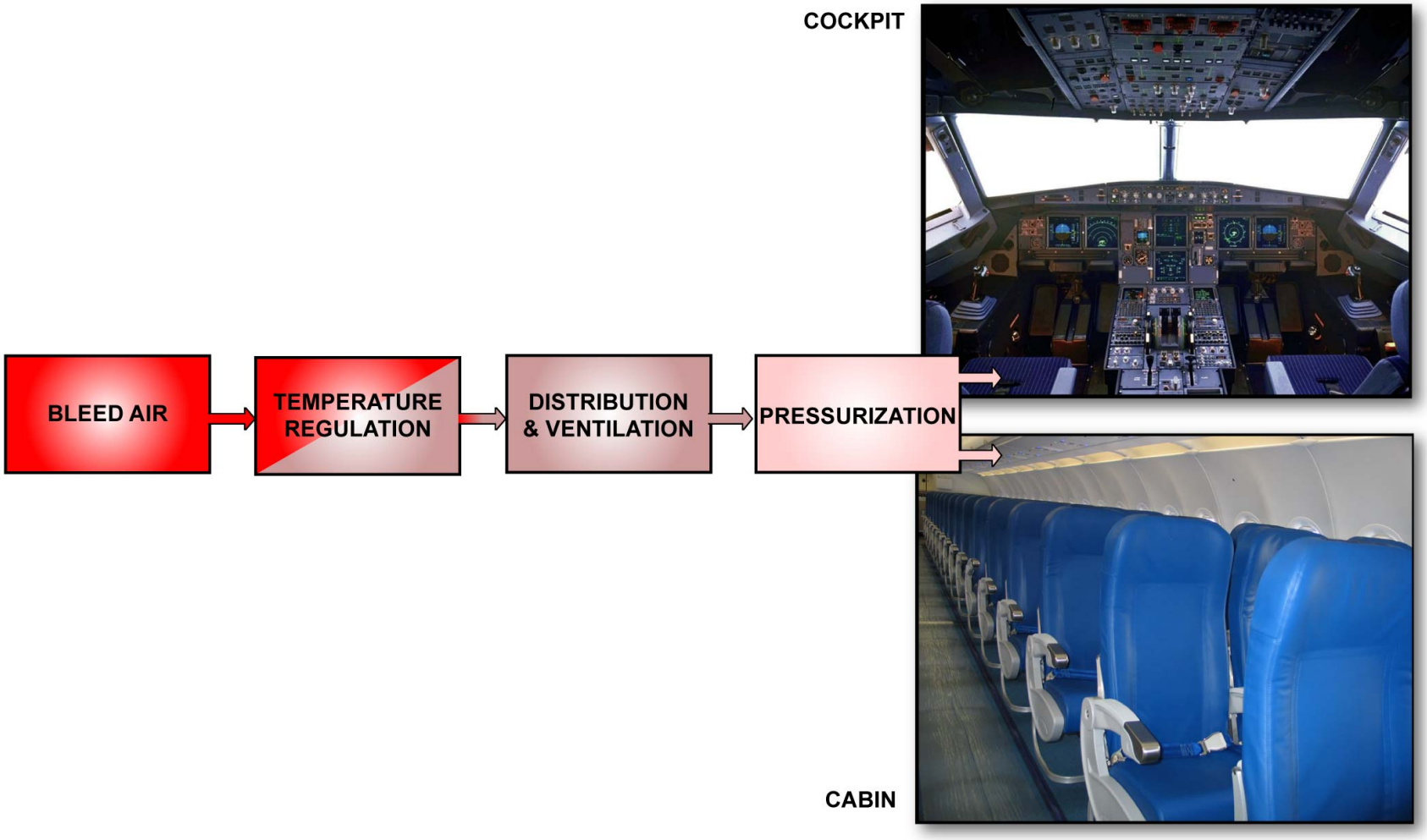
SAFETY PRECAUTIONS

21 AIR CONDITIONING SYSTEM PRESENTATION (1)

AIR CONDITIONING, VENTILATION AND PRESSURIZATION INTRODUCTION

This chapter is related to the air conditioning, ventilation and pressurization systems.
The basic airflow through the pressurized part of the fuselage starts with the pneumatic system.
Hot, high pressure air is supplied to two packs. The packs do the basic temperature regulation.
From the packs the air is supplied in all the aircraft.
The pressurization system controls the airflow overboard to keep the cabin pressurization within safe limits.

UGB13131 - U2AT4M0 - UM21PZ00000002



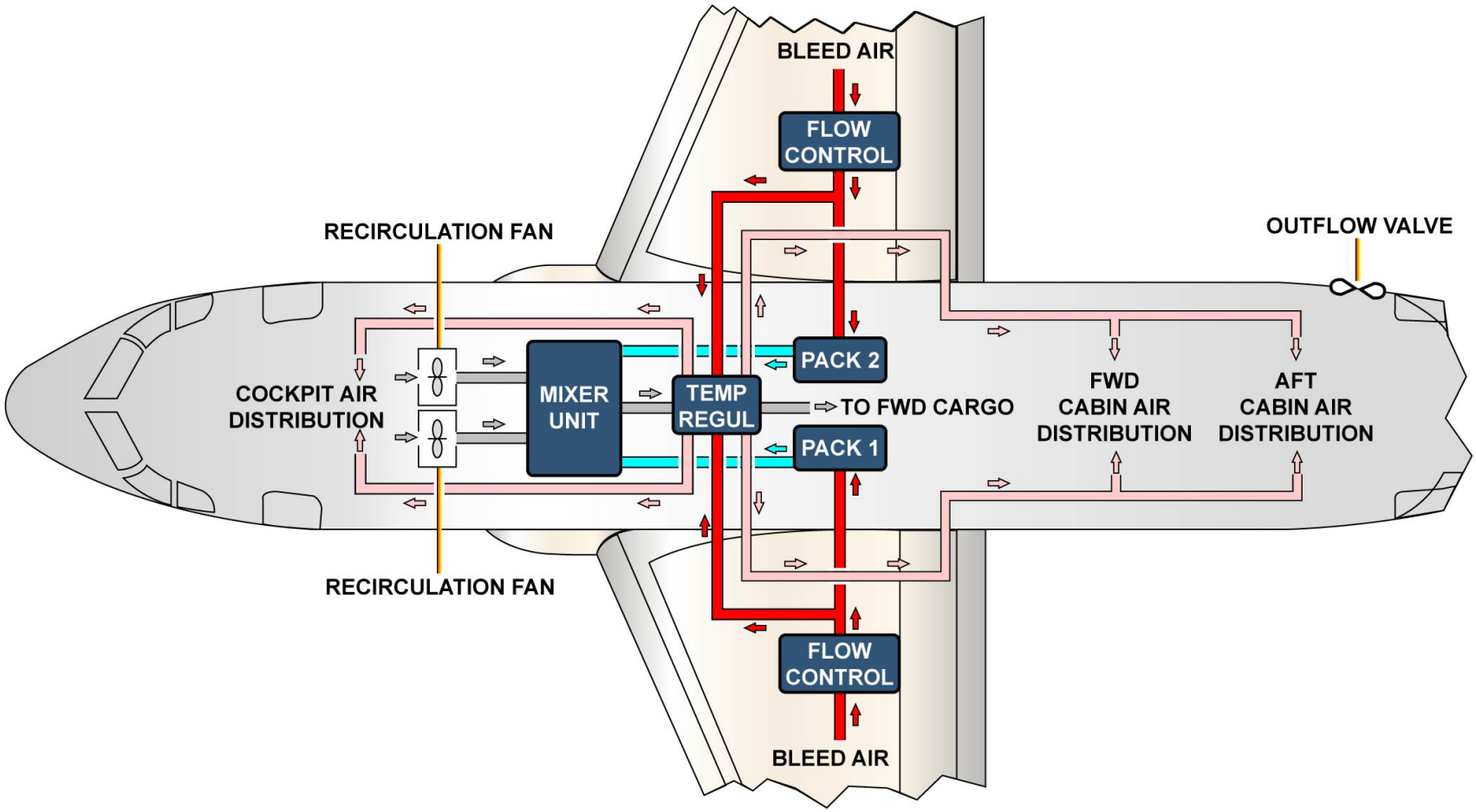
AIR CONDITIONING, VENTILATION AND PRESSURIZATION INTRODUCTION

21 AIR CONDITIONING SYSTEM PRESENTATION (1)

BASIC AIR CONDITIONING SYSTEM INTRODUCTION

The pneumatic system supplies air to each pack. The packs do the BASIC temperature regulation.
Temperature regulated pack discharge air is sent to the mixer unit.
In the mixer unit, the air is mixed with air re-circulated from the main cabin. This reduces the overall bleed demand and the fuel consumption.
From the mixer unit, the air is supplied to the cockpit and the forward and aft cabin zones.
Some of the air from the pneumatic system is used to optimize the temperature regulation. This hot air is mixed with the air from the mixer unit to adjust the temperature in each zone independently.
The air is supplied in all throughout the cabin and, finally, discharged overboard through the outflow valve to keep the pressurization.

UGB13131 - U2AT4M0 - UM21PZ00000002



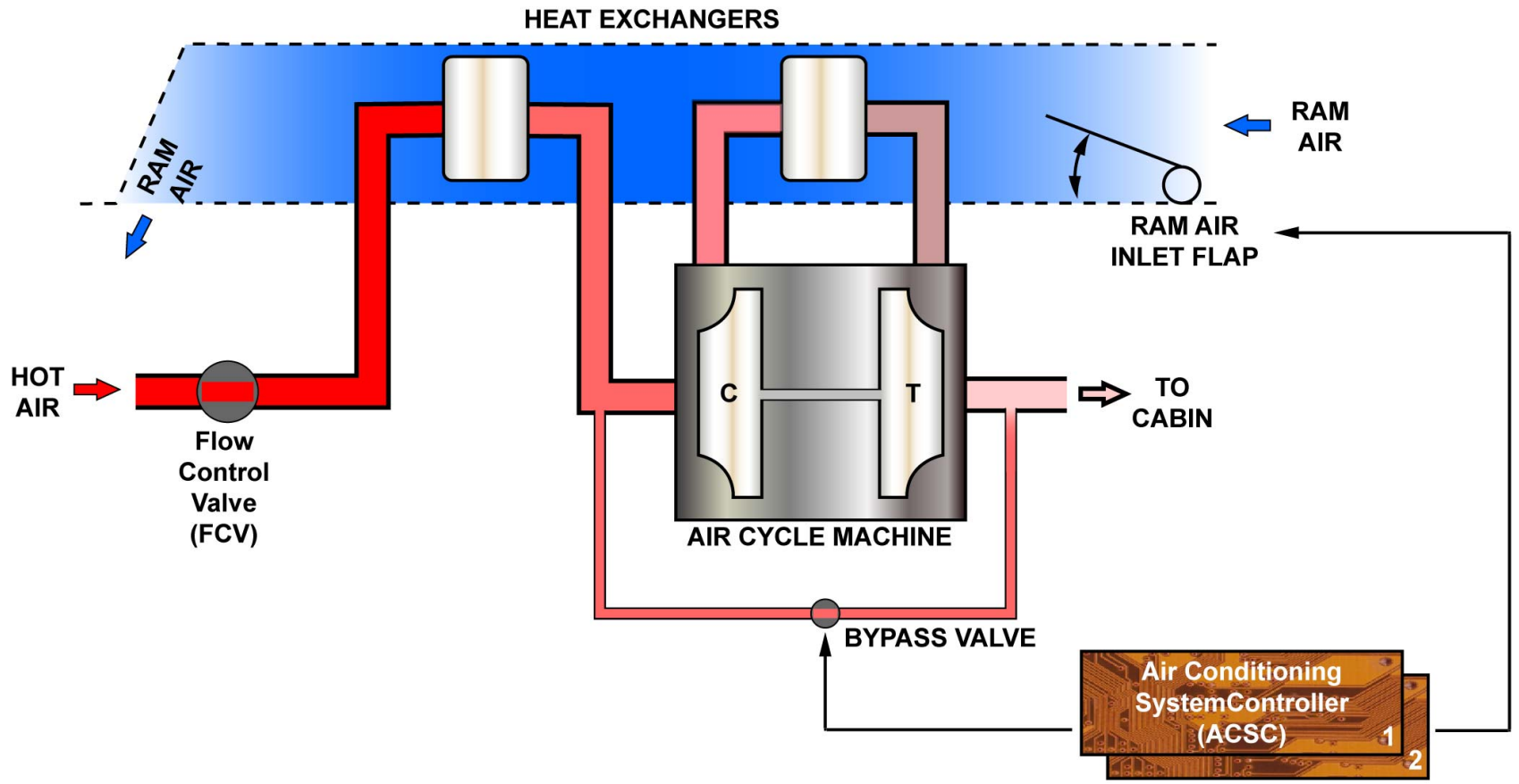
BASIC AIR CONDITIONING SYSTEM INTRODUCTION

21 AIR CONDITIONING SYSTEM PRESENTATION (1)

PACK INTRODUCTION

The Single Aisle family has two air conditioning packs. The packs supply dry air to the cabin for air conditioning, ventilation and pressurization. The main component of each pack assembly is the air cycle machine. Hot air from the pneumatic system is supplied to the pack through the pack Flow Control Valve (FCV). The FCV adjusts the flow rate through the pack and is the pack Shut-Off Valve (SOV).
There are two Air Conditioning System Controllers (ACSC 1 and 2). ACSC 1 controls the pack outlet temperature of pack 1. ACSC 2 controls the pack outlet temperature of pack 2. To change the pack outlet temperature, each ACSC modulates the BYPASS VALVE and the RAM-AIR INLET door of its pack. For maximum cooling, the ram-air door is fully open and the bypass valve is fully closed. For maximum heating, the ram-air door is almost closed and the bypass valve is fully open. During takeoff and landing, the ram air inlet doors are in the minimum open position, to prevent too much contamination of the heat exchangers.

UGB13131 - U2AT4M0 - UM21PZ00000002



PACK INTRODUCTION

21 AIR CONDITIONING SYSTEM PRESENTATION (1)

ZONE TEMPERATURE REGULATION SYSTEM INTRODUCTION

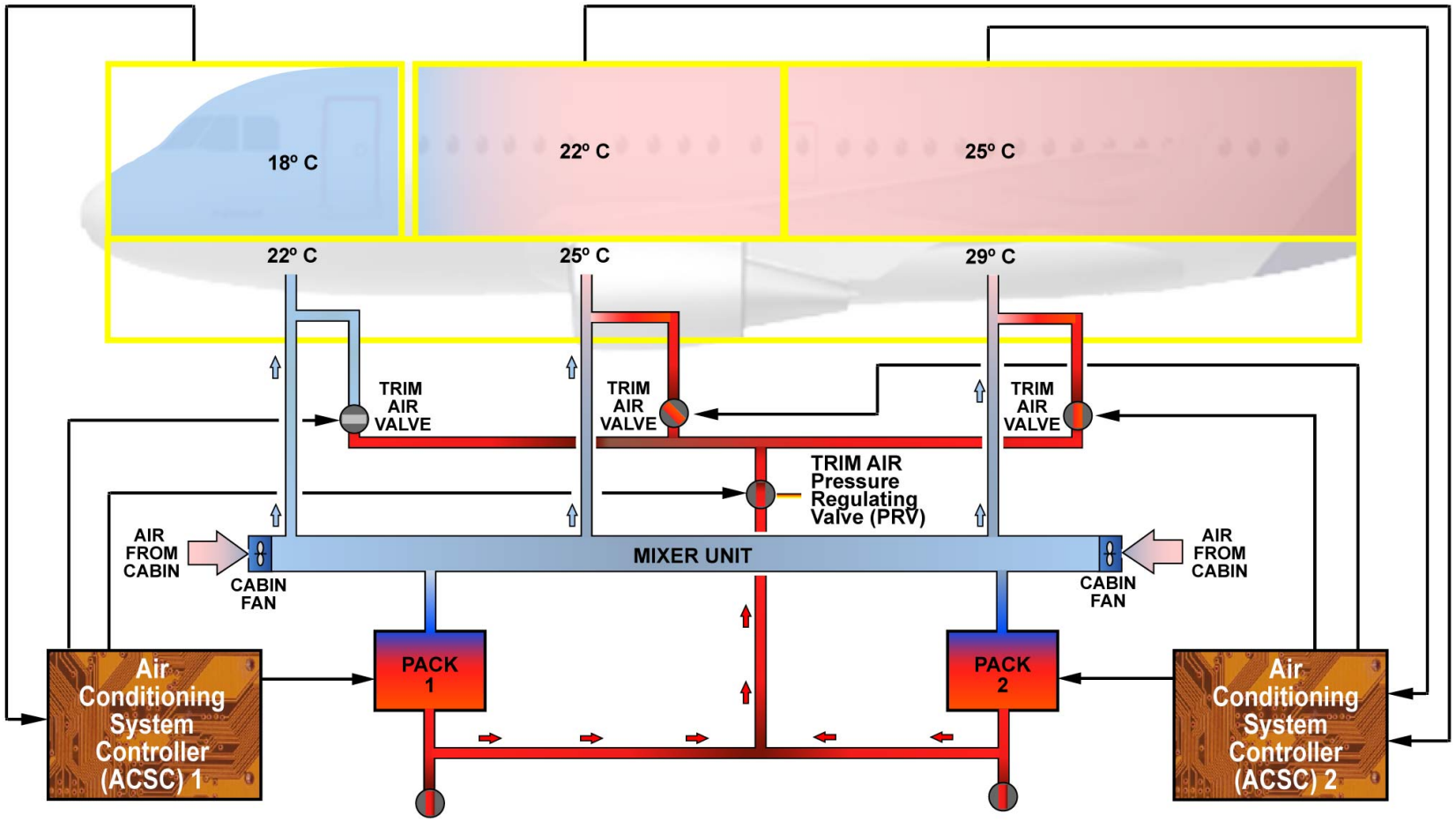
The packs supply air to the mixer unit. Three separate aircraft zones are supplied from the mixer unit:
- Cockpit,
- Forward cabin,
- Aft cabin.

Two cabin recirculation fans are installed to reduce the bleed air demand and the fuel consumption. These fans supply a recirculation flow of air from the cabin zones to the mixer unit. In normal operation, there are no ECAM indications related to with the cabin fans.

The ACSCs control and monitor the temperature regulation system for the cabin zones. On the overhead AIR CONDitioning panel, the flight crew selects the desired individual compartment temperature. The ACSC compares the demand to the actual temperature in each zone. ACSC 1 monitors the temperature of the flight deck zone and controls the outlet temperature of pack 1. ACSC 2 monitors the temperature of the forward and aft cabin and controls the outlet temperature of pack 2. In normal condition, the outlet temperature of the two packs is the same and is called BASIC temperature. It is related to the lowest cabin zone temperature demand.

The trim air Pressure Regulating Valve (PRV) and the trim air valves are controlled by the ACSCs. If there is duct overheat, the Trim air PRV and the trim air valves will automatically close to isolate the system. The system can be reset when the overheat condition stops.

UGB13131 - U2AT4M0 - UM21PZ00000002



ZONE TEMPERATURE REGULATION SYSTEM INTRODUCTION

21 AIR CONDITIONING SYSTEM PRESENTATION (1)

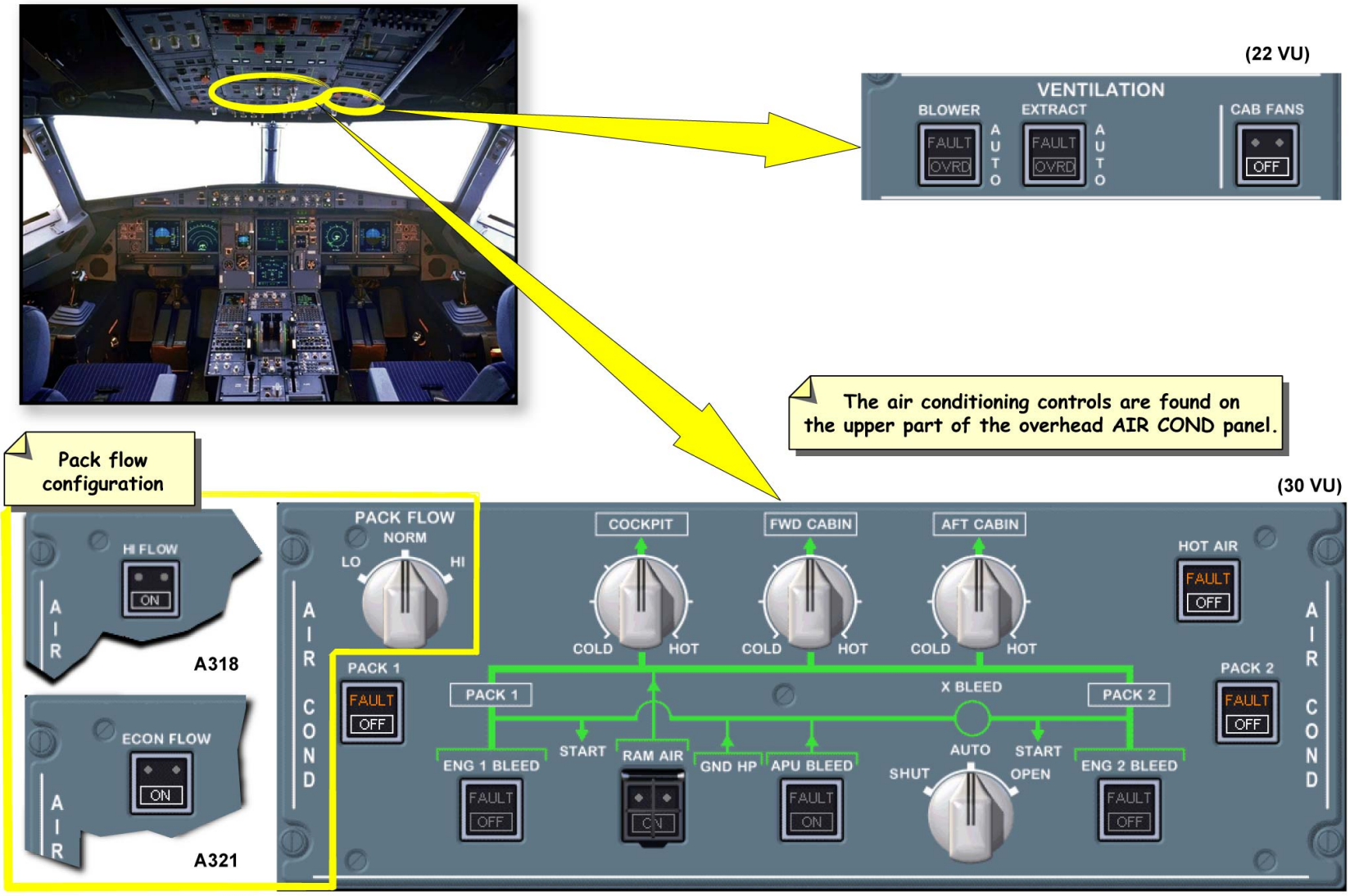
CONTROL AND INDICATING

This section is related to the control panels and indications for the air conditioning system.

CONTROL PANELS

On the overhead panel, the AIR COND panel is used by the pilot to control the air conditioning system. This panel contains the PACK switches, the zone temperature selectors, the PACK FLOW control and the HOT AIR control switch.
On the overhead panel, the VENTILATION panel contains the CABin FANS pushbutton switch. The switch is used to set the recirculation fans to OFF.

UGB13131 - U2AT4M0 - UM21PZ00000002



CONTROL AND INDICATING - CONTROL PANELS

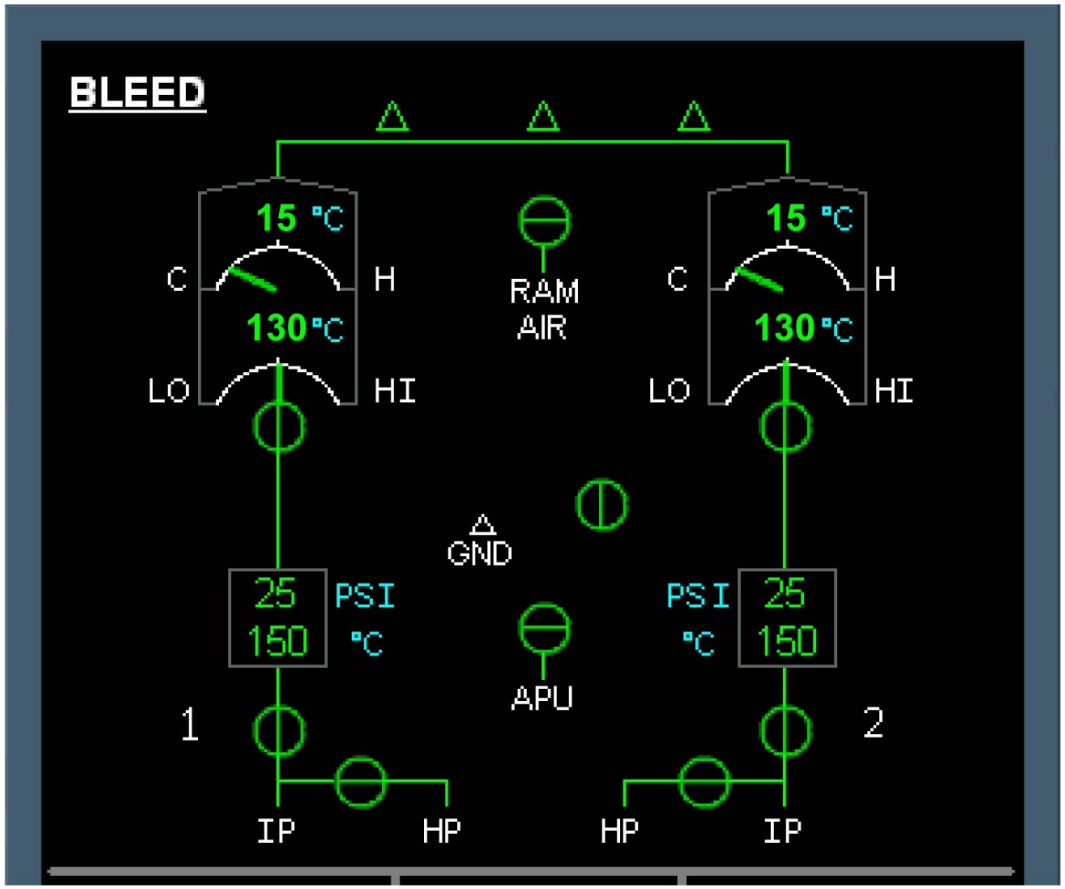
21 AIR CONDITIONING SYSTEM PRESENTATION (1)

CONTROL AND INDICATING (continued)

ECAM PAGES

Pack parameters, such as pack flow, bypass valve position and pack outlet temperature, are found in the upper section of the ECAM BLEED page.
The ECAM AIR COND page contains the optimized temperature regulation parameters, such as duct temperature, zone temperature and trim air system indications.
The ECAM CRUISE page also contains zone temperature indications.

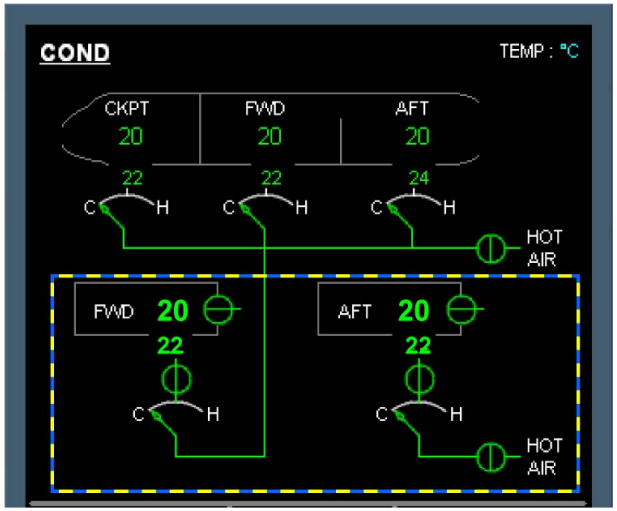
BLEED PAGE



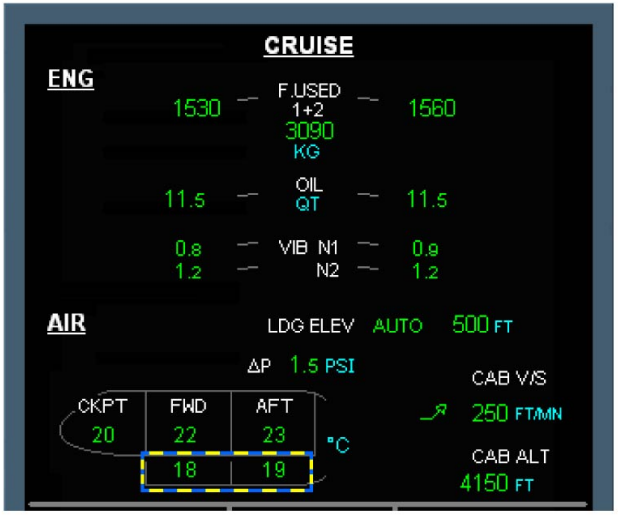
The upper part of the ECAM BLEED page shows the air conditioning system valves' status and other parameters.

CONTROL AND INDICATING - ECAM PAGES

AIR COND PAGE



CRUISE PAGE



OPTIONAL

FWD and aft cargo ventilation and heating are both optional systems.

Cabin and cargo zone temperatures are also indicated on the CRUISE page. By pin programming, temperatures may be indicated in degrees Fahrenheit (°F).

CONTROL AND INDICATING - ECAM PAGES

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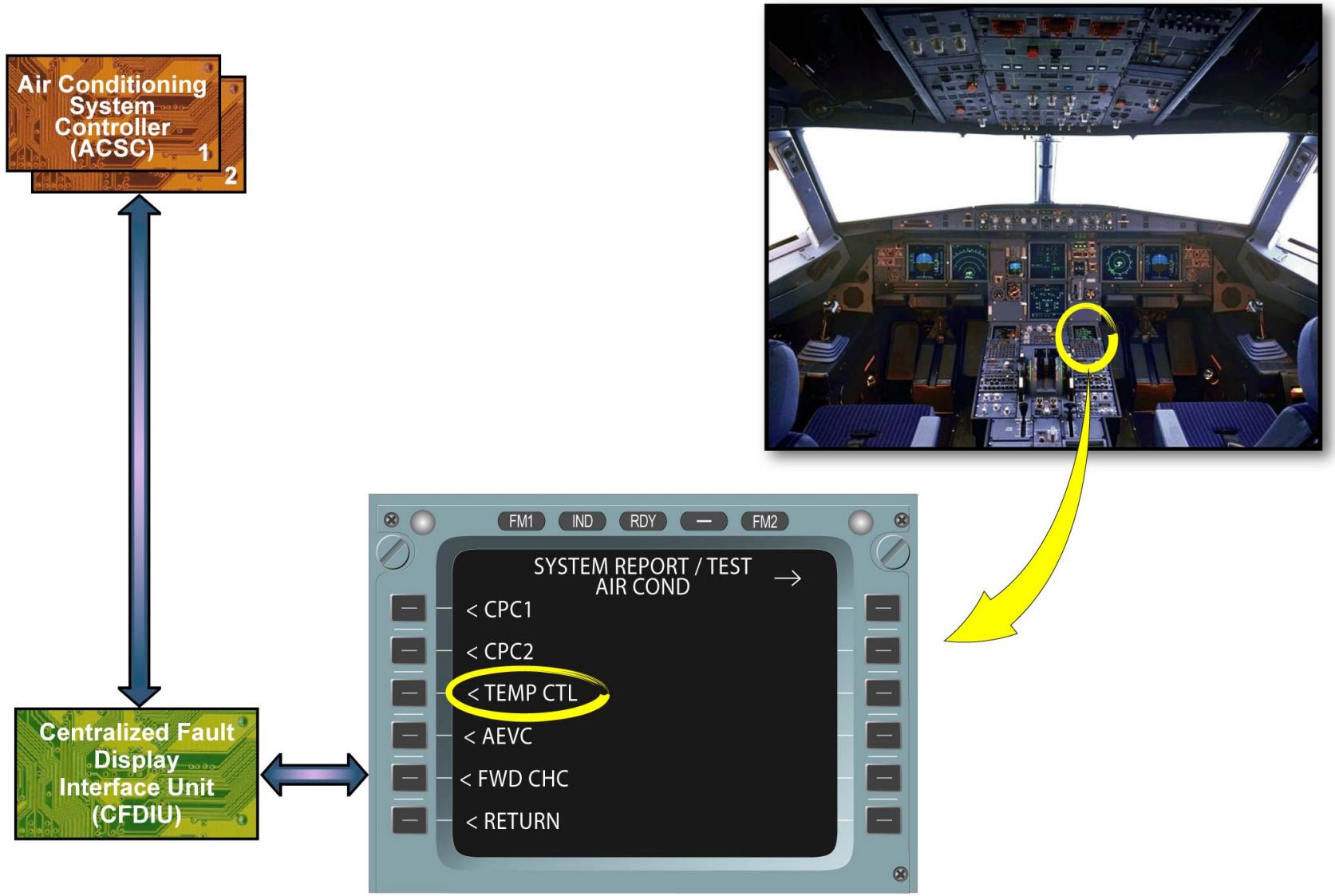
21 AIR CONDITIONING SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The ACSC 2 is connected to the CFDIU for test functions and fault reporting of the temperature control subsystem, available on the MCDU.

UGB13131 - U2AT4M0 - UM21PZ00000002



MAINTENANCE/TEST FACILITIES

21 AIR CONDITIONING SYSTEM PRESENTATION (3)

SAFETY PRECAUTIONS

When you do work on the aircraft, make sure that you obey all the AMM procedures. This will prevent injury to personnel and/or damage to the aircraft. Here is an overview of the main safety procedures related to the air conditioning system.

Make sure that air is not supplied to the air conditioning system from the main engine, the APU or a ground source during maintenance. Hot compressed air can cause injury to personnel.

When you use dangerous products, wear protective clothing, rubber gloves and goggles as necessary.

Do not touch a component until it is sufficiently cool to prevent burns.

Make sure that there are no personnel or equipment near the ram air outlets and inlets. Hot exhaust gases and inlet suction forces can cause injury to persons and/or damage to equipment.

Keep away from the moving and energized parts when you operate or do a test on the valves and the flaps.

UGB13131 - U2AT4M0 - UM21PZ00000002

WARNING
AMM
OBEY ALL THE AMM SAFETY PROCEDURES.
WARNING
NO PERSONNEL OR EQUIPMENT NEAR THE PACKS INLETS AND OUTLETS
KEEP AWAY FROM MOVING AND ENERGIZED PARTS WHEN YOU OPERATE ON VALVES OR FLAPS.
WARNING
WHEN WORKING ON THE AIR CONDITIONING, MAKE SURE THAT NO AIR IS SUPPLIED TO THE SYSTEM. HOT, COMPRESSED AIR CAN INJURE PERSONNEL.
PACK 1
PACK 2
AIR
ENG 1
GPU
APU
ENG 2
WARNING
USE PROTECTIVE CLOTHING.
DO NOT TOUCH HOT COMPONENTS.

SAFETY PRECAUTIONS

21 VENTILATION SYSTEM PRESENTATION (1)

GENERAL

There are two ventilation systems on the Single Aisle (SA) family: avionics ventilation, and lavatory and galley ventilation.

AVIONICS VENTILATION

The avionics ventilation system supplements the air conditioning system to supply cooling air to the avionics equipment. This equipment includes the avionics compartment, the flight deck instruments and the circuit breaker panels.
A blower fan and an extraction fan supply the air through the avionics equipment.

NOTE: Note: These fans operate continuously while the A/C electrical system is supplied.

The Avionics Equipment Ventilation Computer (AEVC) controls the fans and the configuration of the skin valves in the avionics ventilation system in relation to the flight/ground logic and the fuselage skin temperature.
There are 3 configurations for the skin air inlet and outlet valves:
- Open circuit: the two valves are open (on ground only),
- Closed circuit: the two valves are closed (in flight or low outside air temperature on ground). The air temperature is decreased in the skin heat exchanger. The skin heat exchanger lets the warm air from the avionics equipment flow along the cold inner surface of the upper fuselage skin. Two frames of the aircraft structure are closed to the inside by panels and make two rectangular ducts,
- Intermediate circuit: inlet closed, outlet not fully open.

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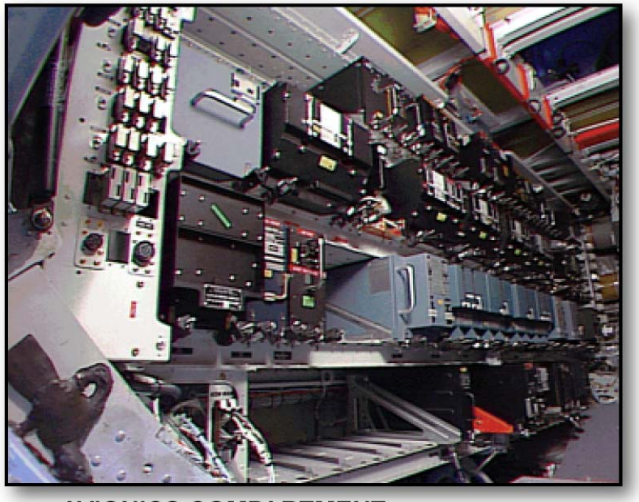
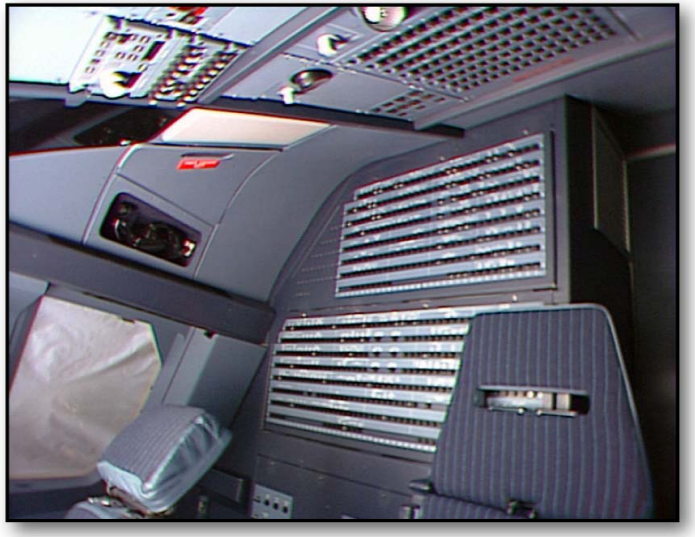
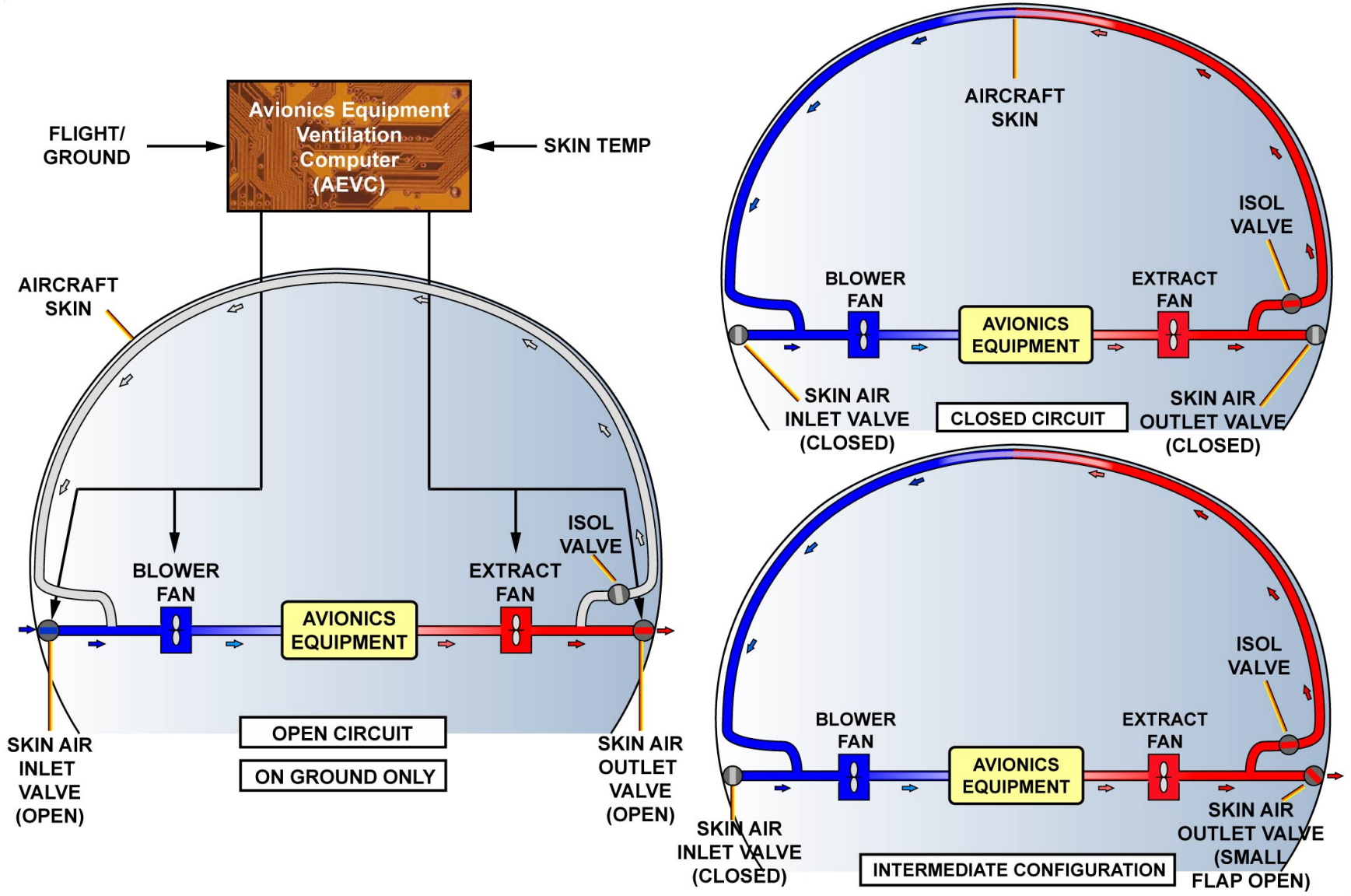


AVIONICS COMPARTMENT

FLIGHT DECK INSTRUMENTS



CIRCUIT BREAKER PANELS



GENERAL & AVIONICS VENTILATION

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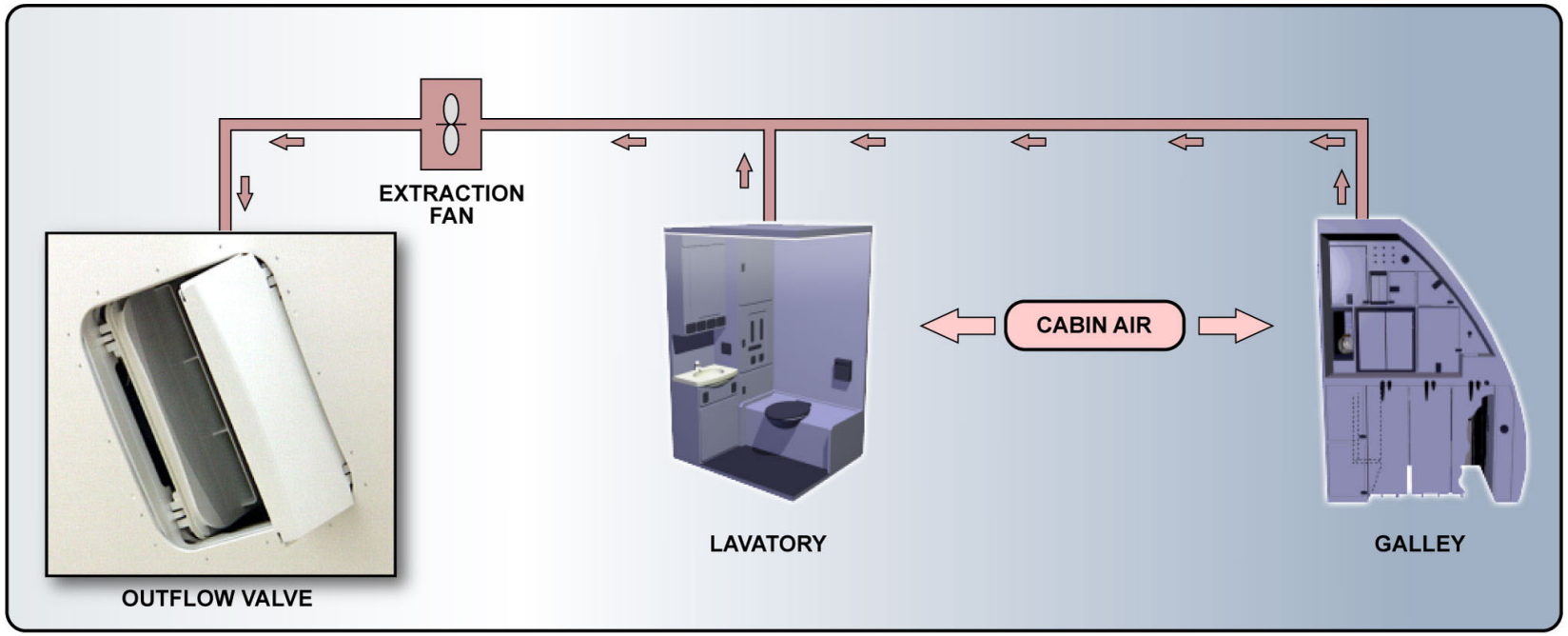
21 VENTILATION SYSTEM PRESENTATION (1)

LAVATORY AND GALLEY VENTILATION

The function of the lavatory and galley ventilation system is to have a permanent flow of conditioned air in these areas.
Cabin air flows into the lavatory and galley areas and is removed from these areas by an extraction fan. The fan pulls air through the ceiling into an extraction duct. The air is then discharged overboard through the outflow valve.

NOTE: The extraction fan operates continuously, while the aircraft electrical system is supplied.

UGB13131 - U2AT4M0 - UM21PY000000002



LAVATORY AND GALLEY VENTILATION

21 VENTILATION SYSTEM PRESENTATION (1)

VENTILATION PANEL

The VENTILATION panel contains two P/Bs related to the ventilation system. With the BLOWER and EXTRACT switches in the AUTO position (lights off), the avionics ventilation system is fully automatic and no pilot inputs are necessary.

VENTILATION PANEL

21 VENTILATION SYSTEM PRESENTATION (1)

ECAM CAB PRESS PAGE

A section of the ECAM CABin PRESSure page displays avionics ventilation system information. The skin valve configuration is displayed on this page.

OPEN CIRCUIT

INTERMEDIATE

CLOSED CIRCUIT

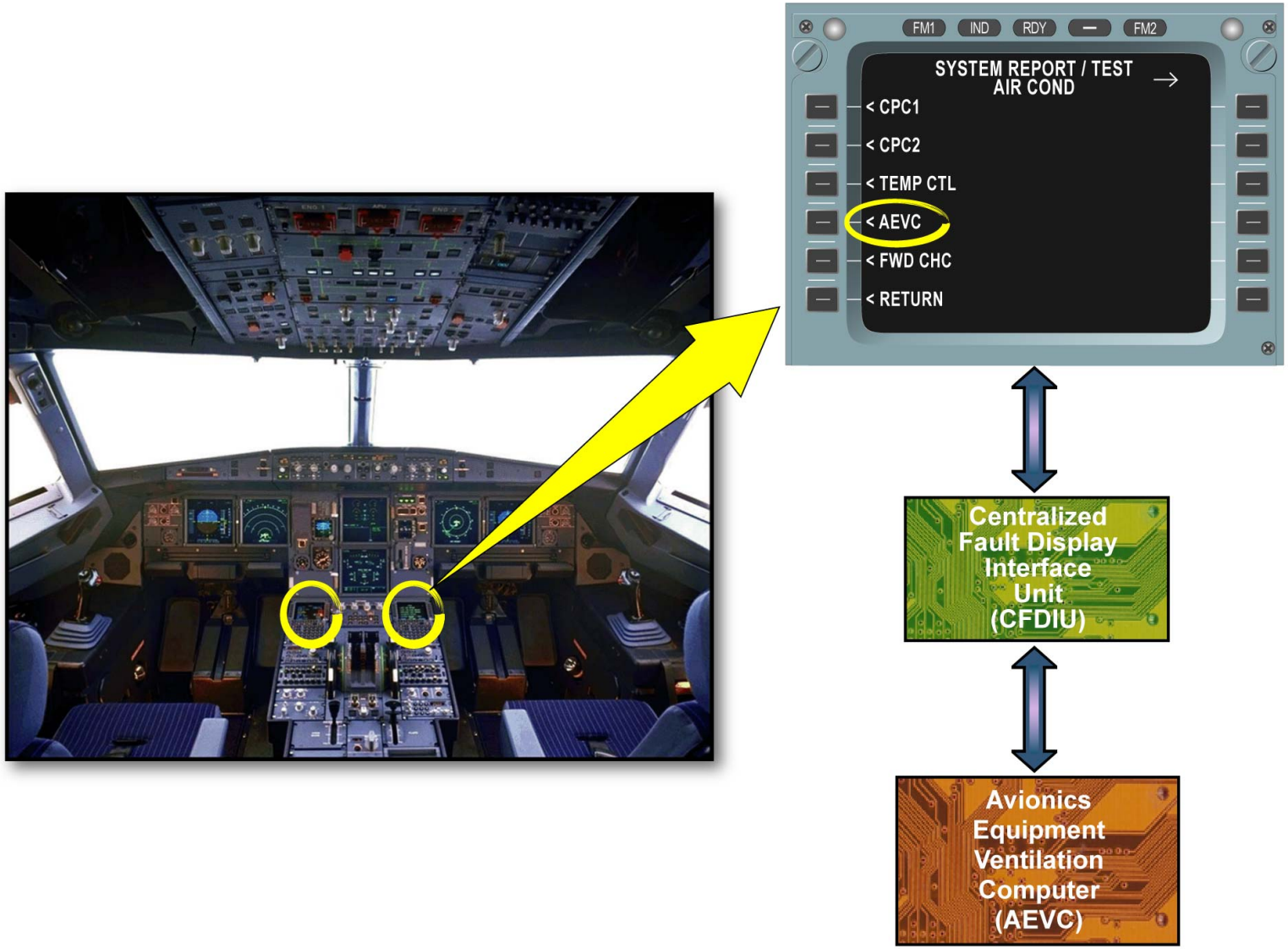
ECAM CAB PRESS PAGE

21 VENTILATION SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The AEVC is connected to the Centralized Fault Display Interface Unit (CFDIU) for test functions and fault reporting, available on the MCDUs.

UGB13131 - U2AT4M0 - UM21PY000000002



MAINTENANCE/TEST FACILITIES

21 VENTILATION SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you do work on the A/C, make sure that you obey all the AMM procedures. This will prevent injury to personnel and/or damage to the A/C. Here is an overview of the main safety procedures related to the ventilation system.
Do not use force to turn the manual handles of the valves. There are shear pins in the handles.
Do not use your fingers to operate the deactivation switches. If the system is energized, the valves can move.

AVIONICS EQPT VENT
AIR OUTLET VALVE
CAUTION
HIGH HOT AIR FLOW
WARNING
AVIONICS EQPT VENT
AIR INLET VALVE
DO NOT USE FORCE TO TURN THE MANUAL HANDLES OF THE VALVES.
THERE ARE SHEAR PINS IN THE HANDLES.
DO NOT USE YOUR FINGERS TO OPERATE THE DEACTIVATION SWITCHES.
IF THE SYSTEM IS ENERGIZED, THE VALVES CAN MOVE.

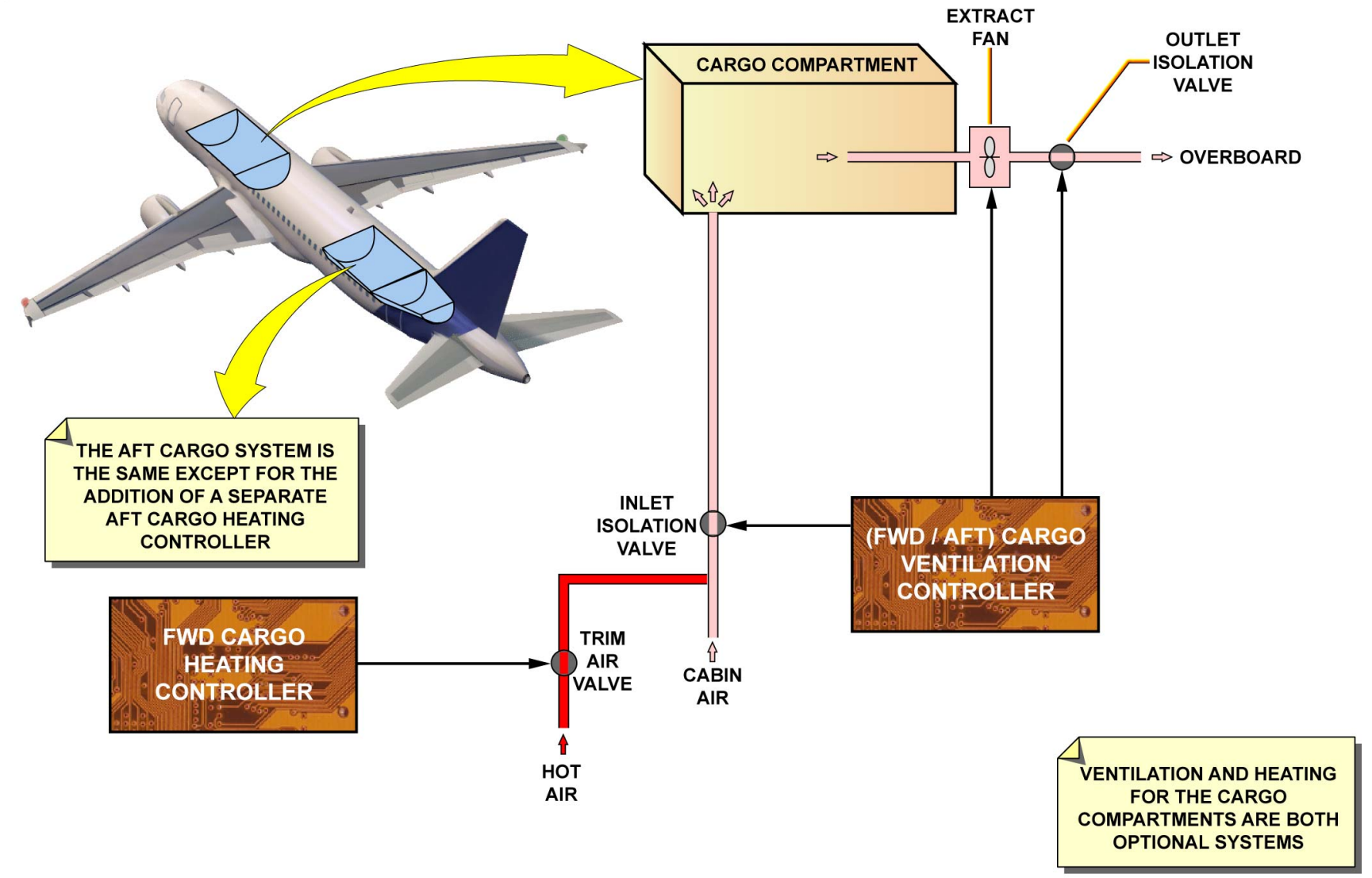
SAFETY PRECAUTIONS

21 CARGO VENTILATION & HEATING SYS PRES. (1)

SYSTEM INTRODUCTION

As an option on the Airbus Single Aisle family, the forward and aft cargo compartments can have a ventilation system. In addition, a heating system can be installed in one compartment or the two compartments. The heating system will only be installed together with a ventilation system.
The operation for the two compartments is similar so we will only look at the forward cargo compartment. The extract fan sends the air from the main cabin to the cargo compartment. After its circulation through the cargo compartment, the air is discharged overboard.
The operation of the two isolation valves and the extract fan is controlled automatically by the cargo Ventilation Controller (VC). The VC can control one compartment at a time or the two compartments.
For the heating of the cargo compartment, the pilots select the desired compartment temperature and hot bleed air is mixed with the air that comes from the main cabin to increase the temperature if necessary. The supply of hot air is controlled by the Cargo Heating Controller. Each heated compartment has a dedicated Cargo Heating Controller. There is NO direct air conditioning supply to the cargo compartments. The pilots cannot add "cold" air to the compartments.

UGB13131 - U2AT4M0 - UM21PX000000001


EXTRACT FAN
CARGO COMPARTMENT
OUTLET ISOLATION VALVE
OVERBOARD
THE AFT CARGO SYSTEM IS THE SAME EXCEPT FOR THE ADDITION OF A SEPARATE AFT CARGO HEATING CONTROLLER
INLET ISOLATION VALVE
(FWD / AFT) CARGO VENTILATION CONTROLLER
FWD CARGO HEATING CONTROLLER
TRIM AIR VALVE
CABIN AIR
HOT AIR
VENTILATION AND HEATING FOR THE CARGO COMPARTMENTS ARE BOTH OPTIONAL SYSTEMS

SYSTEM INTRODUCTION

21 CARGO VENTILATION & HEATING SYS PRES. (1)

CONTROL AND INDICATING

This section is related to the control panels and indications for the cargo ventilation and heating systems.

CONTROL PANELS

The CARGO HEAT panel consists of controls related to cargo ventilation and heating. There can be different variations related to the customer options: ventilation in only one compartment or the two compartments, or ventilation and heating in one compartment or the two compartments.

For each ventilated cargo compartment there is an ISOLATION VALVE P/B switch that controls the isolation valves. In the normal position (pushed), the cargo VC automatically opens and closes the isolation valves.

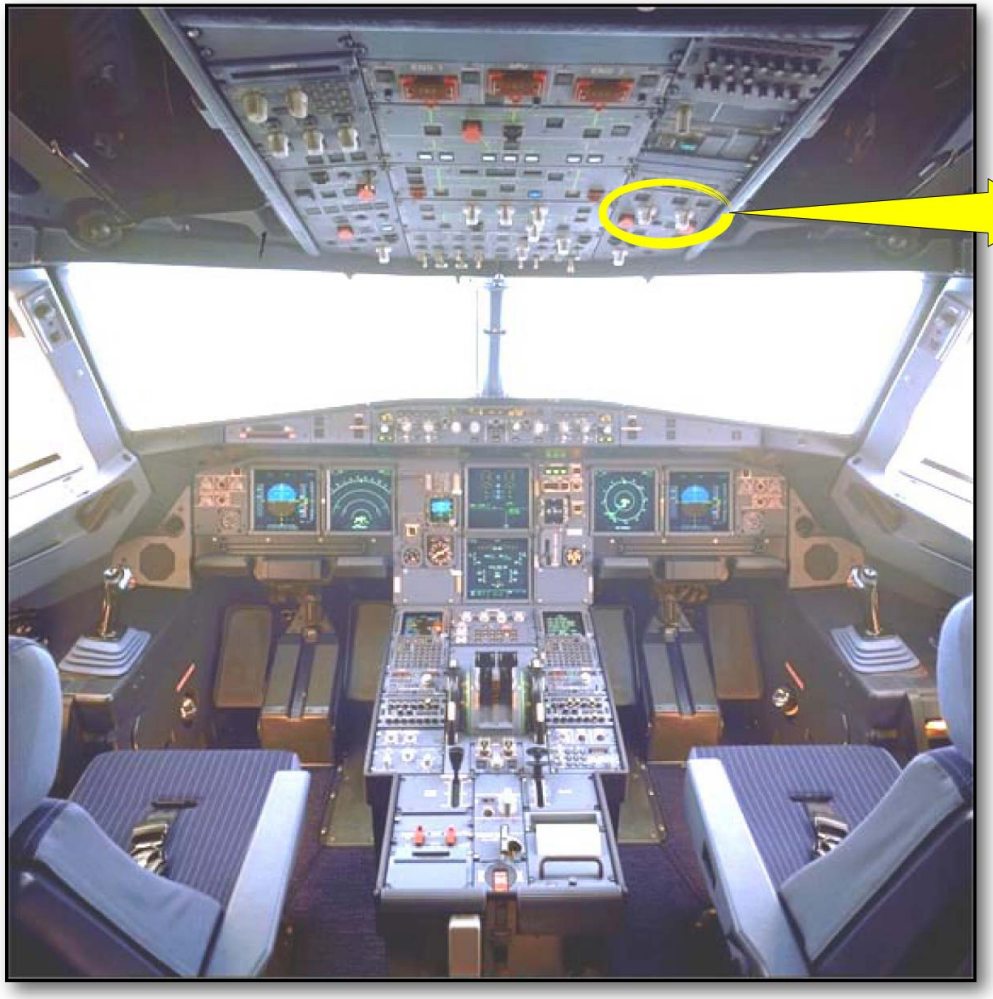
If cargo smoke is detected, the isolation valves of the affected compartment will be automatically closed by the cargo ventilation controller.

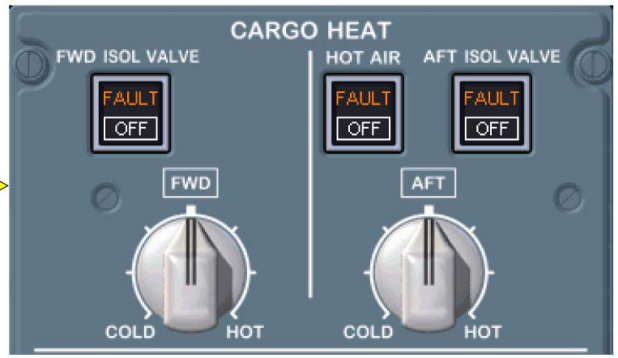
For each heated compartment, the temperature selector sends a signal to the related Cargo Heating Controller.

The Cargo Heating Controller moves the trim air valve to adjust the temperature of the air that goes into the compartment.

The forward cargo trim air system is supplied from the cabin trim air pressure regulating valve. The aft cargo trim air system is supplied by a dedicated trim air pressure regulating valve, which is controlled by the HOT AIR P/B on the Cargo Heat panel.

UGB13131 - U2AT4M0 - UM21PX000000001





(22VU)

VENTILATION AND HEATING FOR THE CARGO COMPARTMENTS ARE BOTH OPTIONAL SYSTEMS

CONTROL AND INDICATING - CONTROL PANELS

21 CARGO VENTILATION & HEATING SYS PRES. (1)

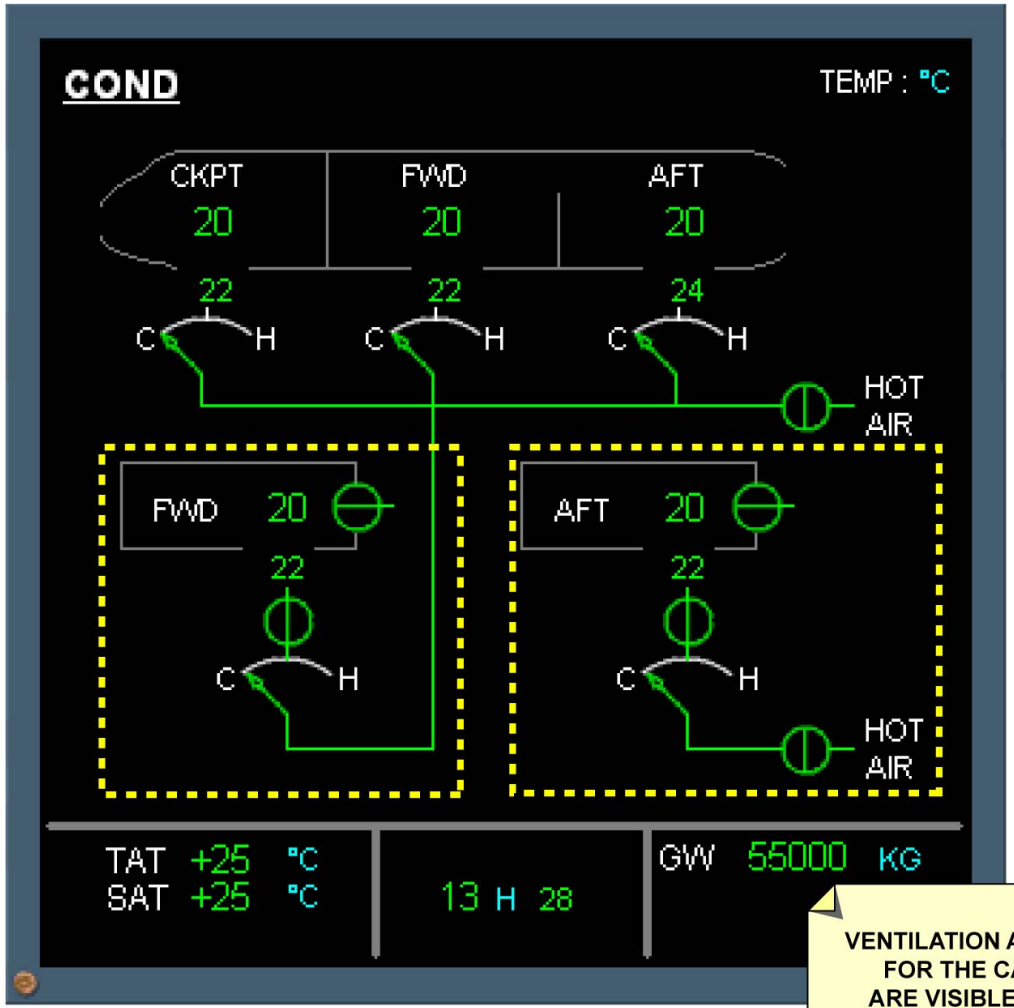
CONTROL AND INDICATING (continued)

ECAM COND PAGE

The indications related to the cargo compartments are displayed on the ECAM COND page. The indications are only displayed if the system is installed.

UGB13131 - U2AT4M0 - UM21PX000000001

SD



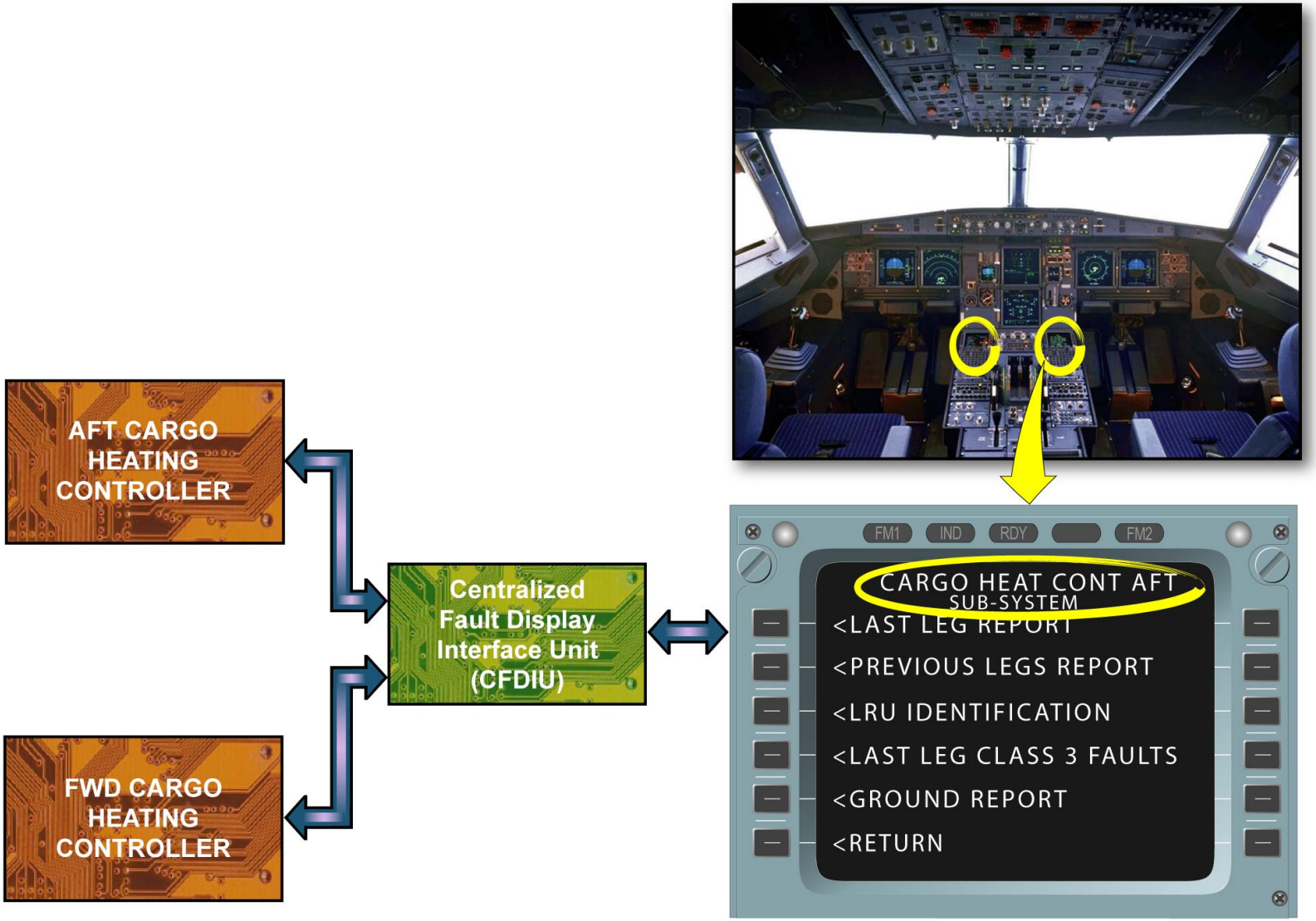
VENTILATION AND HEATING INDICATIONS FOR THE CARGO COMPARTMENTS ARE VISIBLE ONLY IF THE SYSTEM(S) IS(ARE) INSTALLED

CONTROL AND INDICATING - ECAM COND PAGE

21 CARGO VENTILATION & HEATING SYS PRES. (1)

MAINTENANCE/TEST FACILITIES

The two cargo heating controllers are connected to the Centralized Fault Display Interface Unit (CFDIU) for test functions and fault reporting.

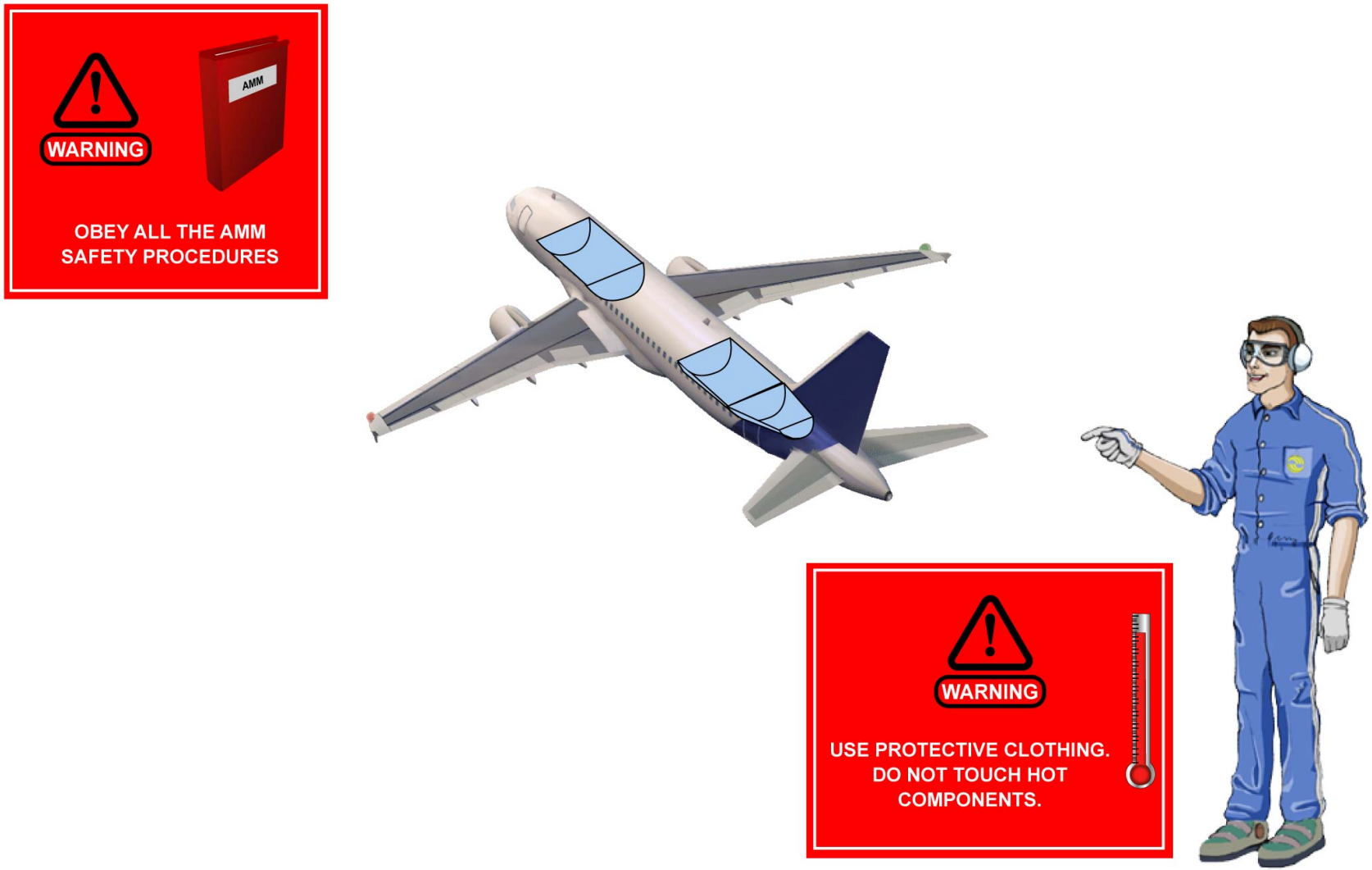


MAINTENANCE/TEST FACILITIES

21 CARGO VENTILATION & HEATING SYS PRES. (1)

SAFETY PRECAUTIONS

When you do work on the aircraft, make sure that you obey all the AMM procedures. This will prevent injury to personnel and/or damage to the aircraft. Here is an overview of the main safety procedures related to the cargo compartment heating and ventilation system.
When you are in contact with dangerous products, use protective clothing, rubber gloves and goggles.
Do not touch a component until it is sufficiently cool to prevent burns.



SAFETY PRECAUTIONS

21 PRESSURIZATION SYSTEM PRESENTATION (1)

SYSTEM INTRODUCTION

The pressurization system on the Single Aisle (SA) family normally operates automatically to adjust the cabin altitude and rate of climb to ensure maximum passenger comfort and safety.
The pressurized areas are:
- The cockpit,
- The avionics bay,
- The cabin,
- The cargo compartments.

The concept of the system is simple. Air is supplied from the air conditioning packs to the pressurized areas.
An Outflow Valve (OFV) is used to regulate the amount of air allowed to escape from the pressurized areas.
Automatic control of the outflow valve is done by two Cabin Pressure Controllers (CPCs). Each CPC controls one electric motor on the outflow valve assembly. The CPC interfaces with other A/C computers to optimize the pressurization/depressurization schedule.
There are two automatic pressurization systems. Each CPC and its electric motor make one system. Only one system operates at a time with the other system used as backup if a failure occurs. The system in command will alternate each flight.
A third motor is installed for manual operation of the outflow valve if there is a failure of the two automatic systems.
Safety valves are installed at the rear pressure bulkhead as a protection to the fuselage against too high cabin differential pressure.
The safety valves also give protection to the fuselage against negative differential pressure.
When the aircraft is on the ground, the Residual Pressure Control Unit (RPCU) prevents residual pressure in the cabin by an automatic control of the Outflow Valve (OFV) to the fully open position through the Manual motor.

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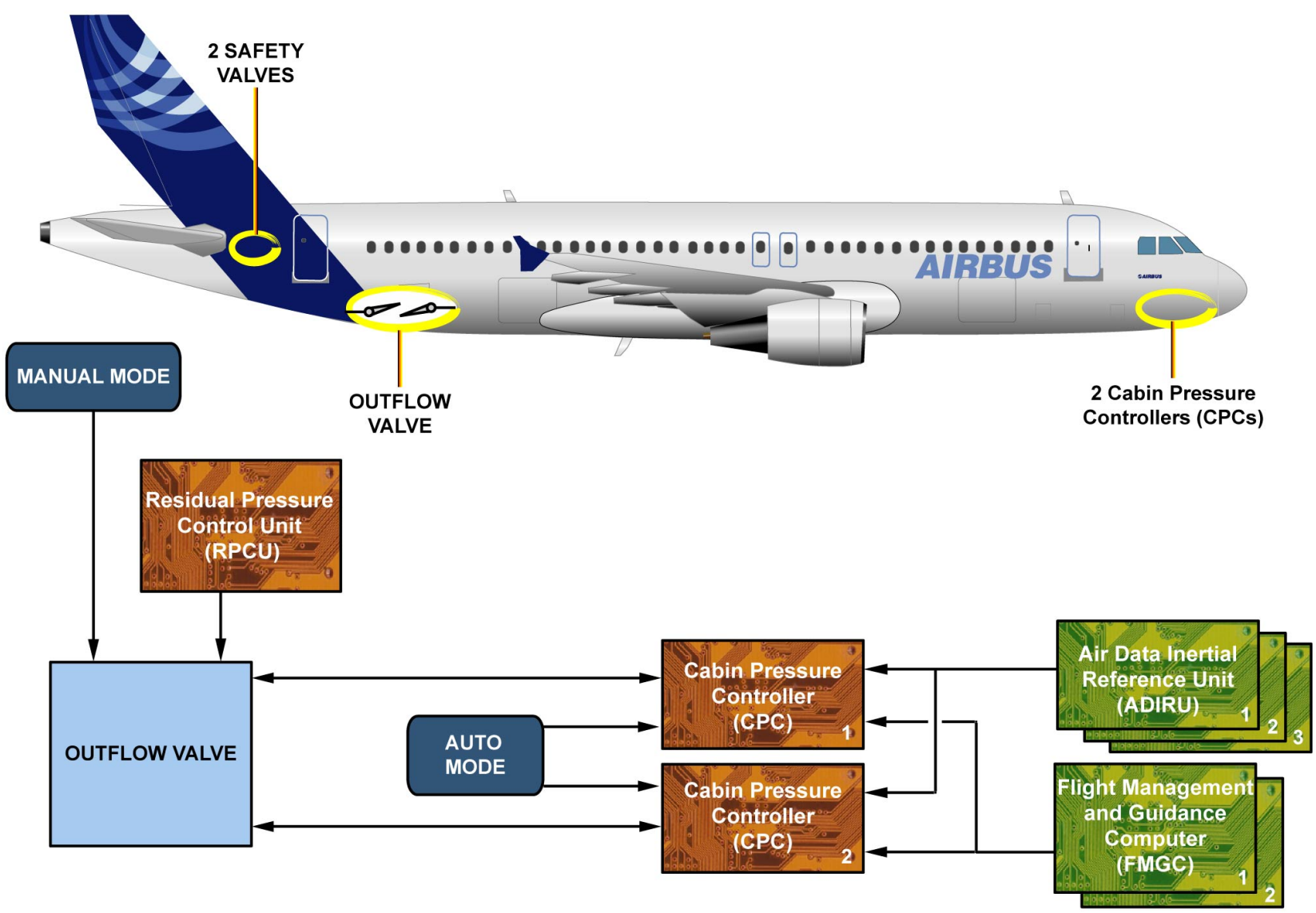

2 SAFETY VALVES
AIRBUS
MANUAL MODE
OUTFLOW VALVE
2 Cabin Pressure Controllers (CPCs)
Residual Pressure Control Unit (RPCU)
OUTFLOW VALVE
AUTO MODE
Cabin Pressure Controller (CPC) 1
Cabin Pressure Controller (CPC) 2
Air Data Inertial Reference Unit (ADIRU) 1 2 3
Flight Management and Guidance Computer (FMGC) 1 2

SYSTEM INTRODUCTION

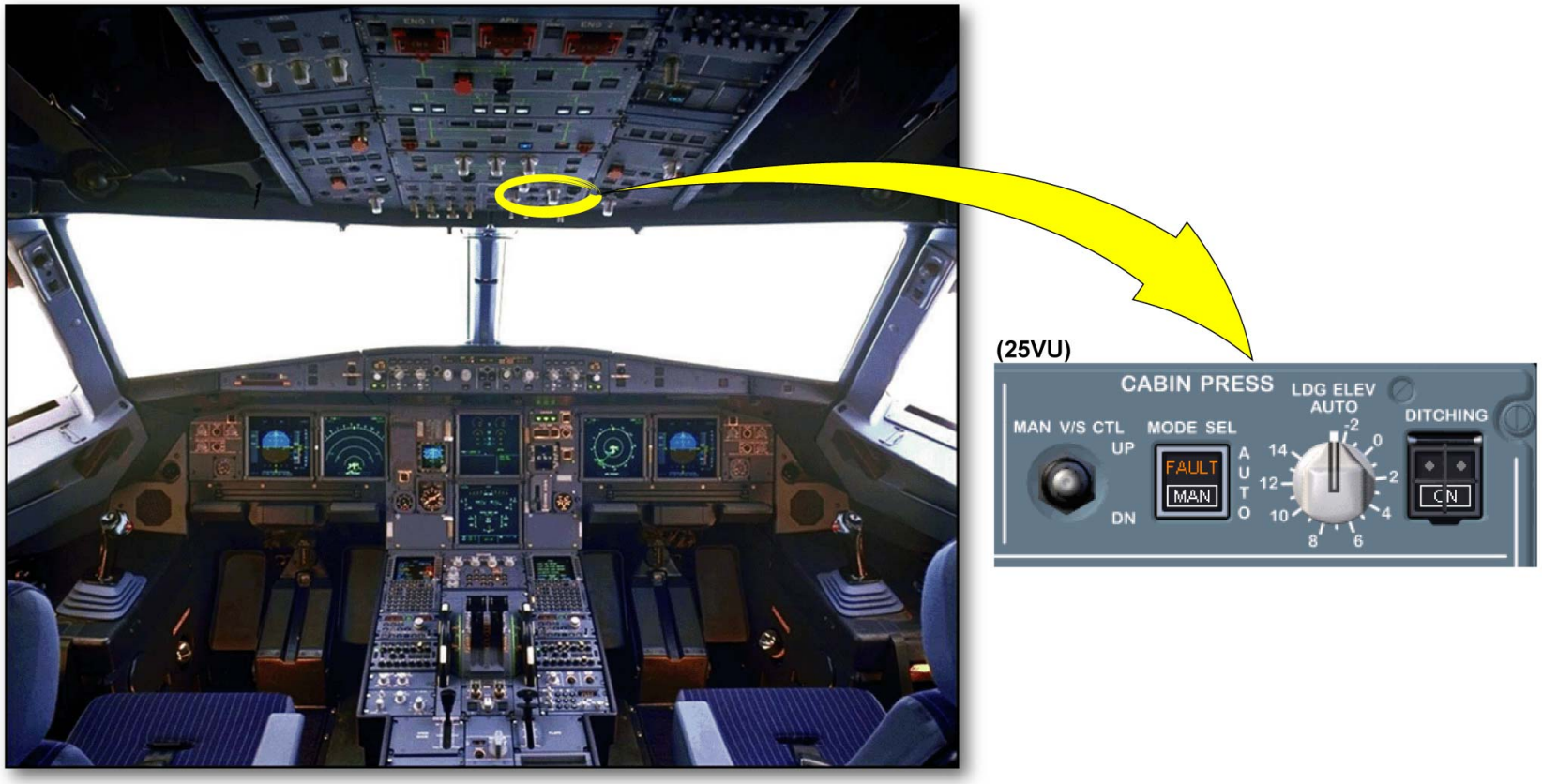
21 PRESSURIZATION SYSTEM PRESENTATION (1)

CONTROL AND INDICATING

This section is related to the control panels and indications for the pressurization system.

CONTROL PANEL

The CABIN PRESSure control panel includes the automatic and manual pressurization controls.
The MODE SELect switch lets the system be used in automatic or manual mode, if there is a failure of the automatic function.
When the manual mode is selected, the MANual Vertical Speed (V/S) ConTroL switch is used to directly control the outflow valve (indirectly, the cabin rate of climb) with the manual motor.
The guarded DITCHING switch is used to close all valves in the lower fuselage to seal the A/C if ditching occurs.



CONTROL AND INDICATING - CONTROL PANEL

21 PRESSURIZATION SYSTEM PRESENTATION (1)

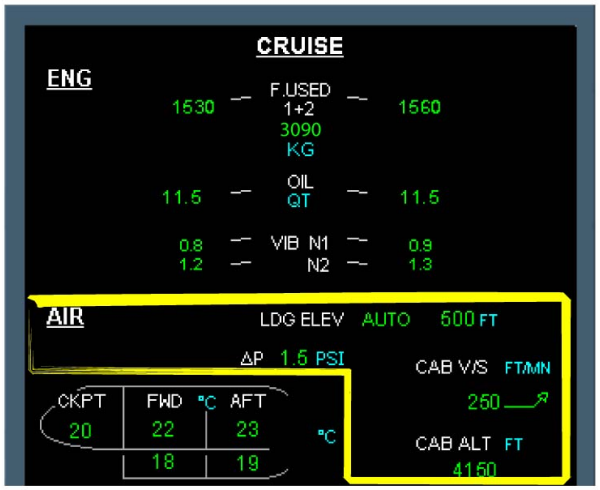
CONTROL AND INDICATING (continued)

ECAM PAGES

The crew can monitor all cabin pressure functions on the ECAM CABin PRESS page.
Some of the pressurization parameters are also shown on the ECAM CRUISE page.

UGB13131 - U2AT4M0 - UM21PW000000002

SD ECAM CAB PRESS PAGE



SD ECAM CRUISE PAGE

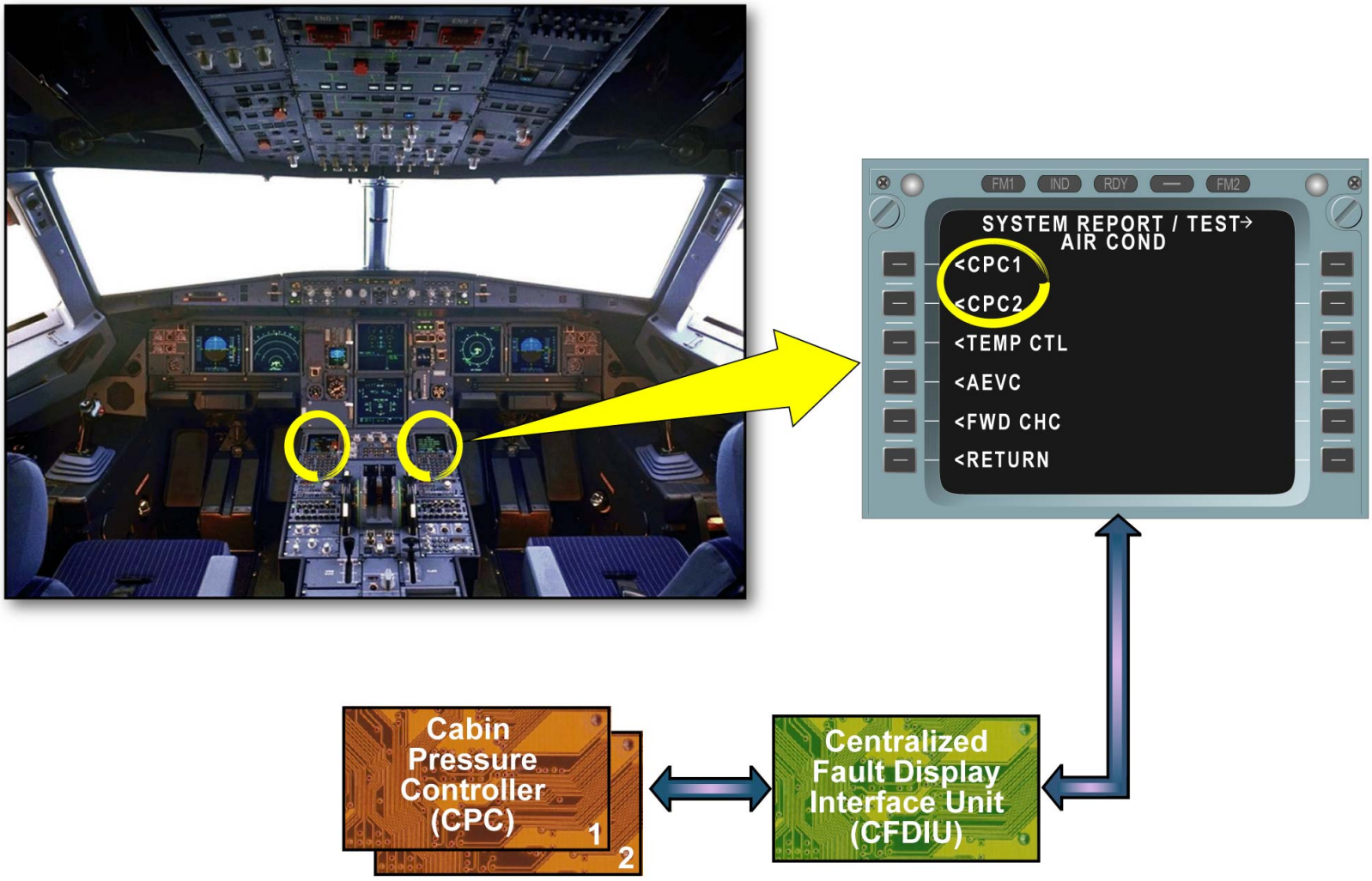
CONTROL AND INDICATING - ECAM PAGES

21 PRESSURIZATION SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The two CPCs are connected to the Centralized Fault Display Interface Unit (CFDIU) for test functions and fault reporting.

UGB13131 - U2AT4M0 - UM21PW000000002

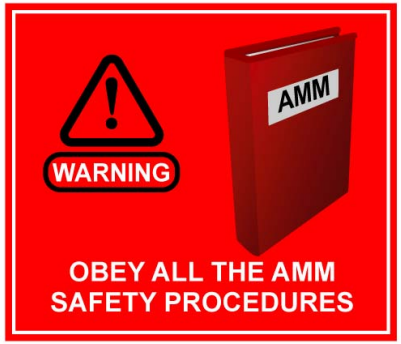


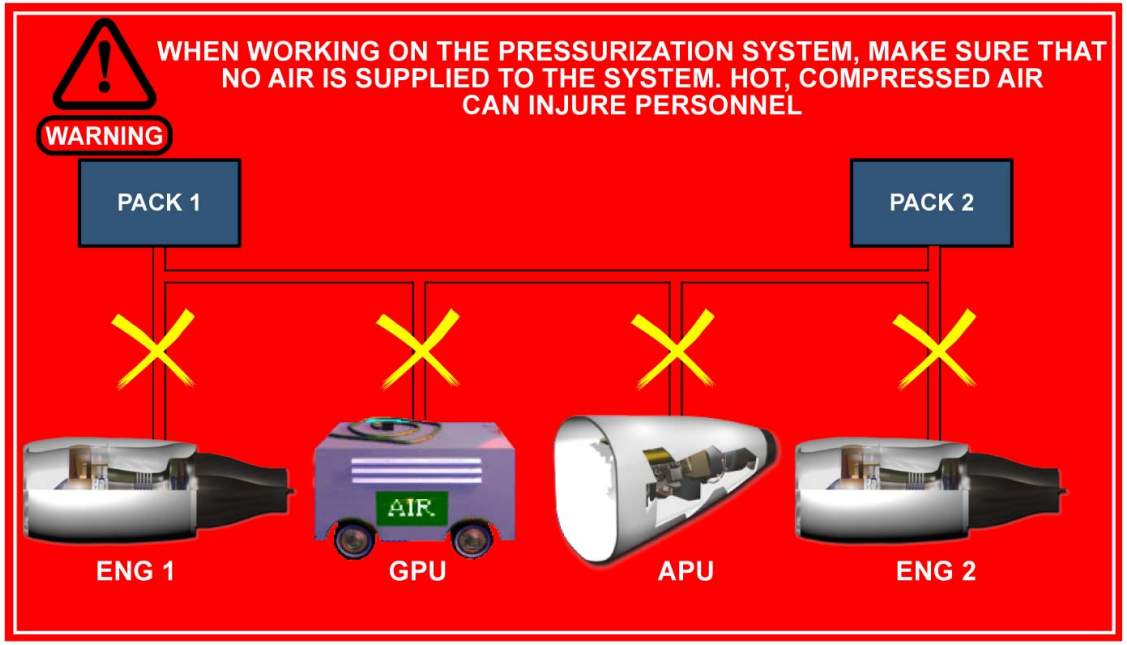
MAINTENANCE/TEST FACILITIES

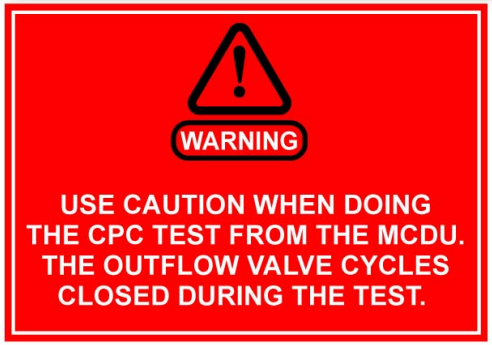
21 PRESSURIZATION SYSTEM PRESENTATION (1)

SAFETY PRECAUTIONS

When you work on A/C, make sure you obey all the Aircraft Maintenance Manual (AMM) procedures. This will prevent injury to personnel and/or damage to the A/C. Here is an overview of the main safety procedures related to the pressurization system.
The outflow valve may be operated manually to pressurize the A/C on the ground.
Use caution when doing the CPC test from the MCDU. The outflow valve cycles closed during the test.







SAFETY PRECAUTIONS

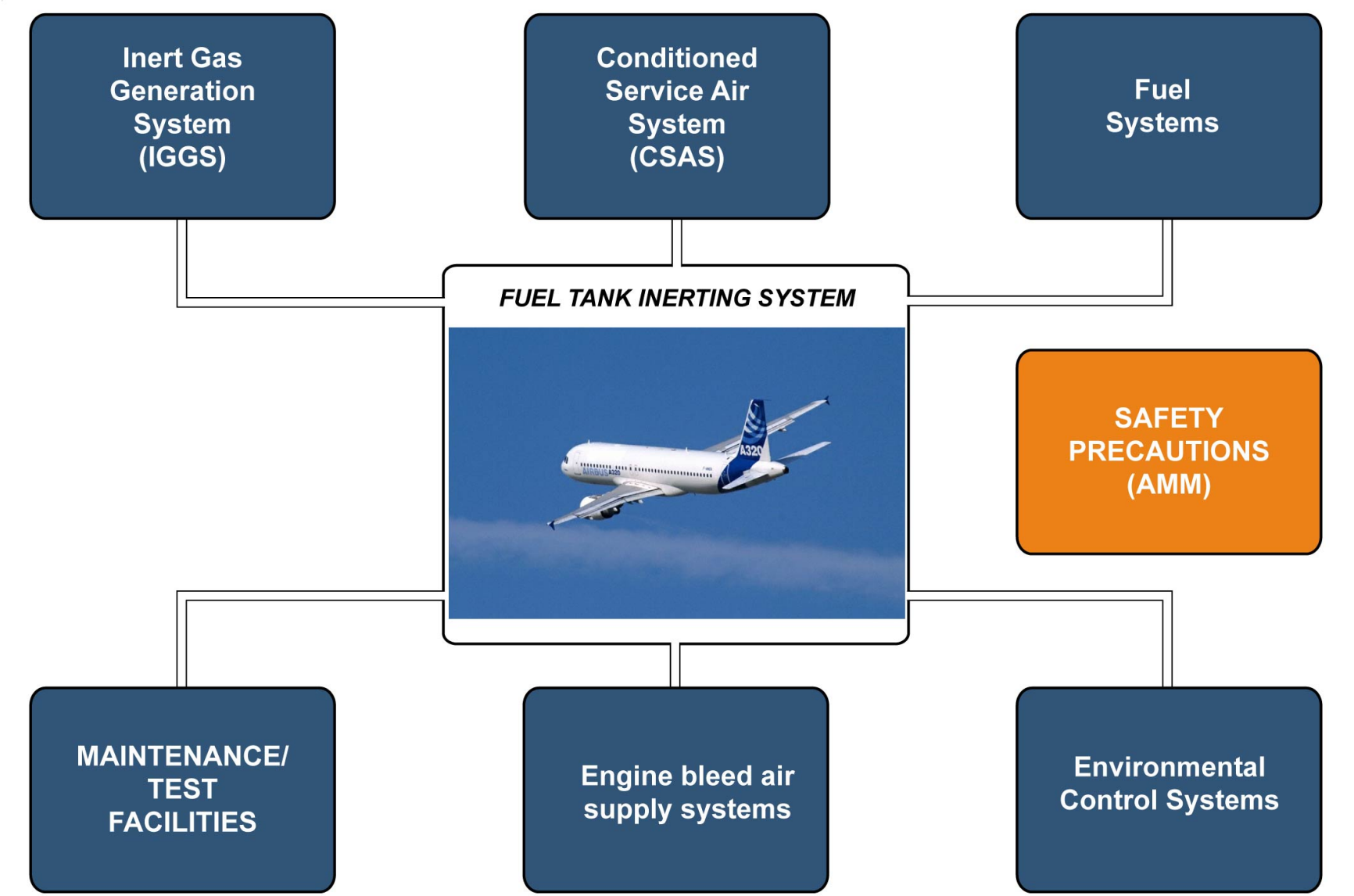
47 FUEL TANK INERTING SYSTEM PRESENTATION (1)

GENERAL

The Fuel Tank Inerting System (FTIS) decreases the amount of oxygen in the air in the center tank.
The FTIS is divided into:
- The Inert Gas Generation System (IGGS),
- The Conditioned Service Air System (CSAS),
- The maintenance/test facilities.

The FTIS interfaces with the systems that follow:
- Fuel System,
- Bleed air supply system,
- Environmental Control Systems,
- Centralized Fault Display System (CFDS) / ECAM.

UGB13131 - U2AT4M0 - UM47PZ000000001


Inert Gas Generation System (IGGS)
Conditioned Service Air System (CSAS)
Fuel Systems
FUEL TANK INERTING SYSTEM
SAFETY PRECAUTIONS (AMM)
MAINTENANCE/ TEST FACILITIES
Engine bleed air supply systems
Environmental Control Systems

GENERAL

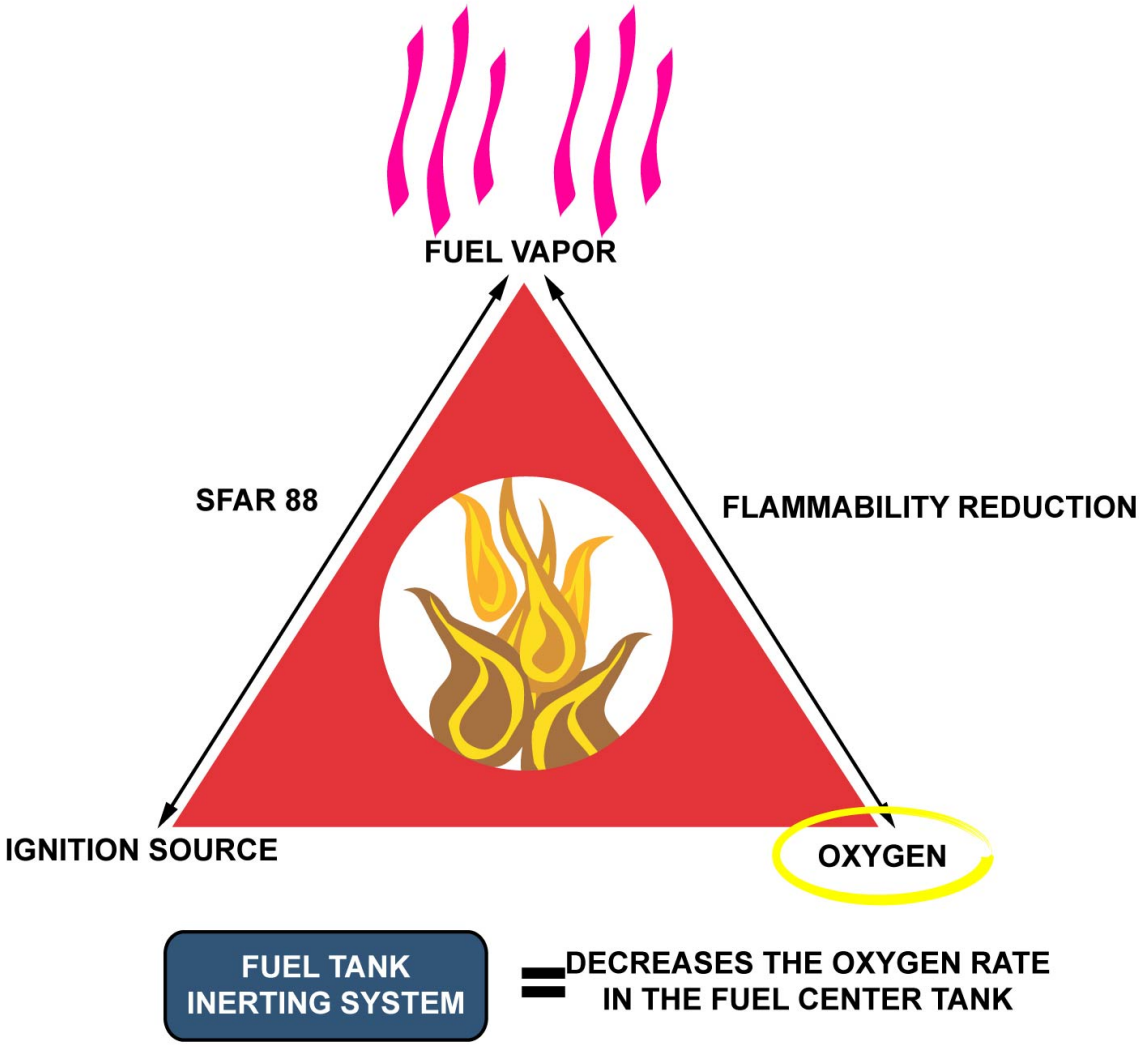
47 FUEL TANK INERTING SYSTEM PRESENTATION (1)

FUEL TANK INERTING SYSTEM FUNCTIONS

Fuel tank flammability is only possible if these three elements are found together: fuel vapor, an ignition source and oxygen.
To prevent the risk of fuel tank flammability, the fuel tank inerting system decreases the oxygen concentration (by percentage), in the center tank only.

UGB13131 - U2AT4M0 - UM47PZ00000001

PREVENTION OF IGNITION AND REDUCTION OF FLAMMABILITY



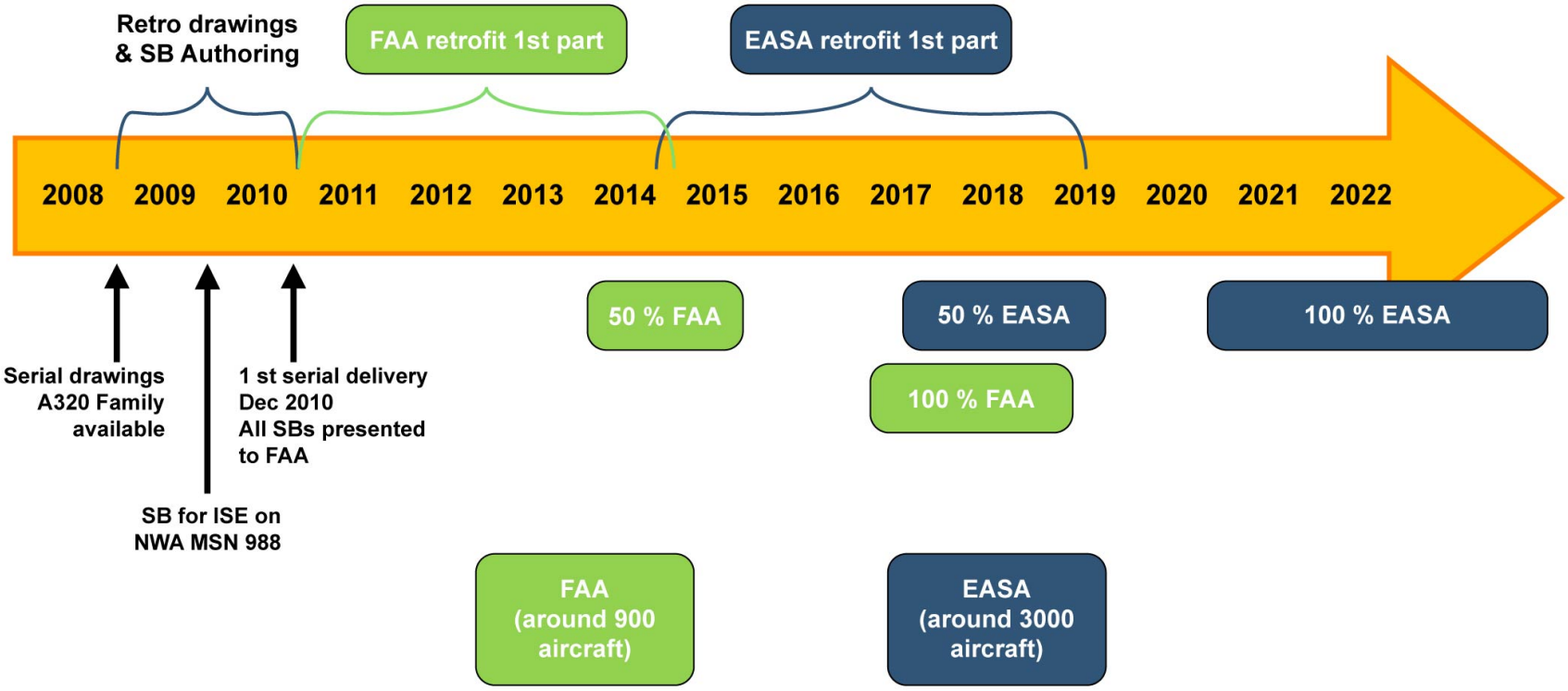
FUEL TANK INERTING SYSTEM FUNCTIONS

47 FUEL TANK INERTING SYSTEM PRESENTATION (1)

SYSTEM INSTALLATION REQUIREMENTS

The picture shows the timetable for system installation as required by the FAA and EASA regulations. The system will be part of the fleet in the next years (i.e.: directly installed on new aircrafts or by retrofit).

UGB13131 - U2AT4M0 - UM47PZ000000001



SYSTEM INSTALLATION REQUIREMENTS

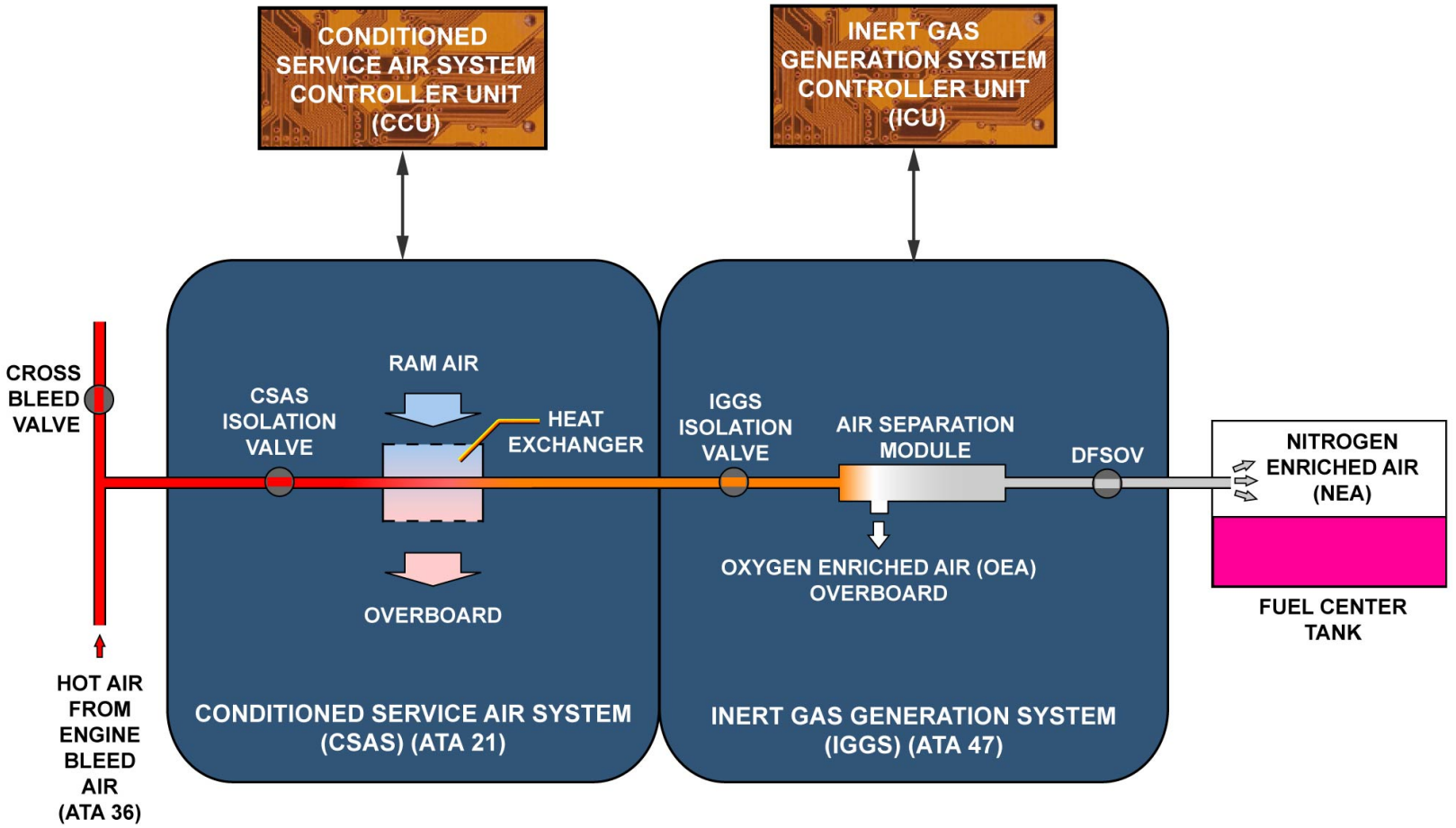
47 FUEL TANK INERTING SYSTEM PRESENTATION (1)

FUEL TANK INERTING SYSTEM GENERAL VIEW

The Fuel Tank Inerting System (FTIS) has two sub-systems:
- The Conditioned Service Air System (CSAS),
- The Inert Gas Generation System (IGGS).

The CSAS uses hot air from the bleed air system and decreases the air temperature to a level compatible with the IGGS sub-system.
The CSAS includes:
- The Conditioned service air system Controller Unit (CCU), which does the system control and health monitoring BITE and interfaces with the FWS and CFDS,
- A CSAS isolation valve, which gives protection to the system if there is low pressure, over pressure or over temperature,
- A heat exchanger to decrease the air temperature.

The IGGS uses an Air Separation Module (ASM) to remove oxygen from the conditioned air stream. The ASM makes and separates the Nitrogen Enriched Air (NEA) and Oxygen Enriched Air (OEA). The OEA is then sent overboard.
The Dual Flow Shut Off Valve (DFSOV) controls the NEA flow to the center tank and lets the system switch between low/middle/high NEA flows and isolates the IGGS from the fuel tank.
The IGGS controller does system control and health monitoring/BITE.
The IGGS isolation valve is a solenoid valve. It is spring-loaded closed.
During operation the IGGS Controller Unit (ICU) controls the valve to open, to let conditioned air come from the CSAS to the IGGS.
It closes if too low pressure and/or overtemperature air come from the heat exchanger.


CONDITIONED SERVICE AIR SYSTEM CONTROLLER UNIT (CCU)
INERT GAS GENERATION SYSTEM CONTROLLER UNIT (ICU)
CROSS BLEED VALVE
RAM AIR
CSAS ISOLATION VALVE
HEAT EXCHANGER
IGGS ISOLATION VALVE
AIR SEPARATION MODULE
DFSOV
NITROGEN ENRICHED AIR (NEA)
OXYGEN ENRICHED AIR (OEA) OVERBOARD
OVERBOARD
FUEL CENTER TANK
HOT AIR FROM ENGINE BLEED AIR (ATA 36)
CONDITIONED SERVICE AIR SYSTEM (CSAS) (ATA 21)
INERT GAS GENERATION SYSTEM (IGGS) (ATA 47)

CSAS: Conditioned Service Air System
DFSOV: Dual Flow Shut Off Valve
IGGS: Inert Gas Generation System

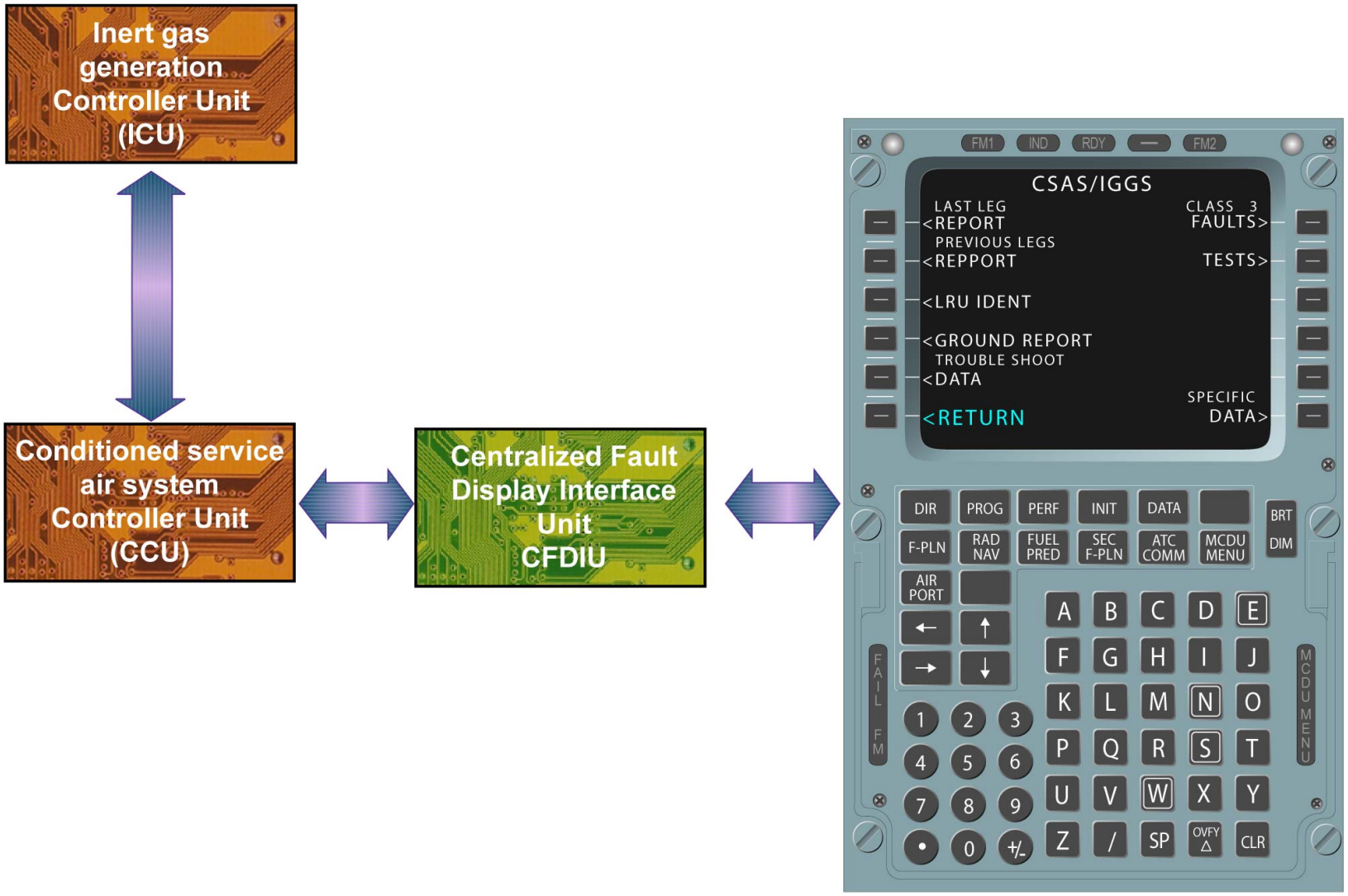
FUEL TANK INERTING SYSTEM GENERAL VIEW

47 FUEL TANK INERTING SYSTEM PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The CCU interfaces with the ICU.
The two controllers monitor the operational conditions independently.
The CSAS receives temperature data from the ICU and, if necessary, adjusts the temperature.
The Centralized Fault Display Interface Unit (CFDIU) gives test functions of the CCU, available through the MCDU in the cockpit.
The CCU also has BITE functions of the ICU.

UGB13131 - U2AT4M0 - UM47PZ000000001



MAINTENANCE/TEST FACILITIES

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

SYSTEM INTRODUCTION

The ice and rain protection system enables unrestricted operation in icing conditions and heavy rain.
For anti-icing, hot air or electrical heating protects critical areas of the aircraft.
The different subsystems of the ice and rain protection system are:
- Wing ice protection,
- Engine air intake ice protection,
- Probe ice protection,
- Windshield ice and rain protection,
- Drain mast ice protection,
- Water and waste system ice protection (some are optional),
- Visual lighted ice detection,
- Electronic ice detection system (optional).

OPTIONAL PROTECTION SYSTEMS:
- ELECTRONIC ICE DETECTION
- WATER & WASTE ICE PROTECTION
WINDSHIELD ICE & RAIN PROTECTION
ENGINE AIR INTAKE ICE PROTECTION
WING ICE PROTECTION
PROBES ICE PROTECTION
DRAIN MAST ICE PROTECTION

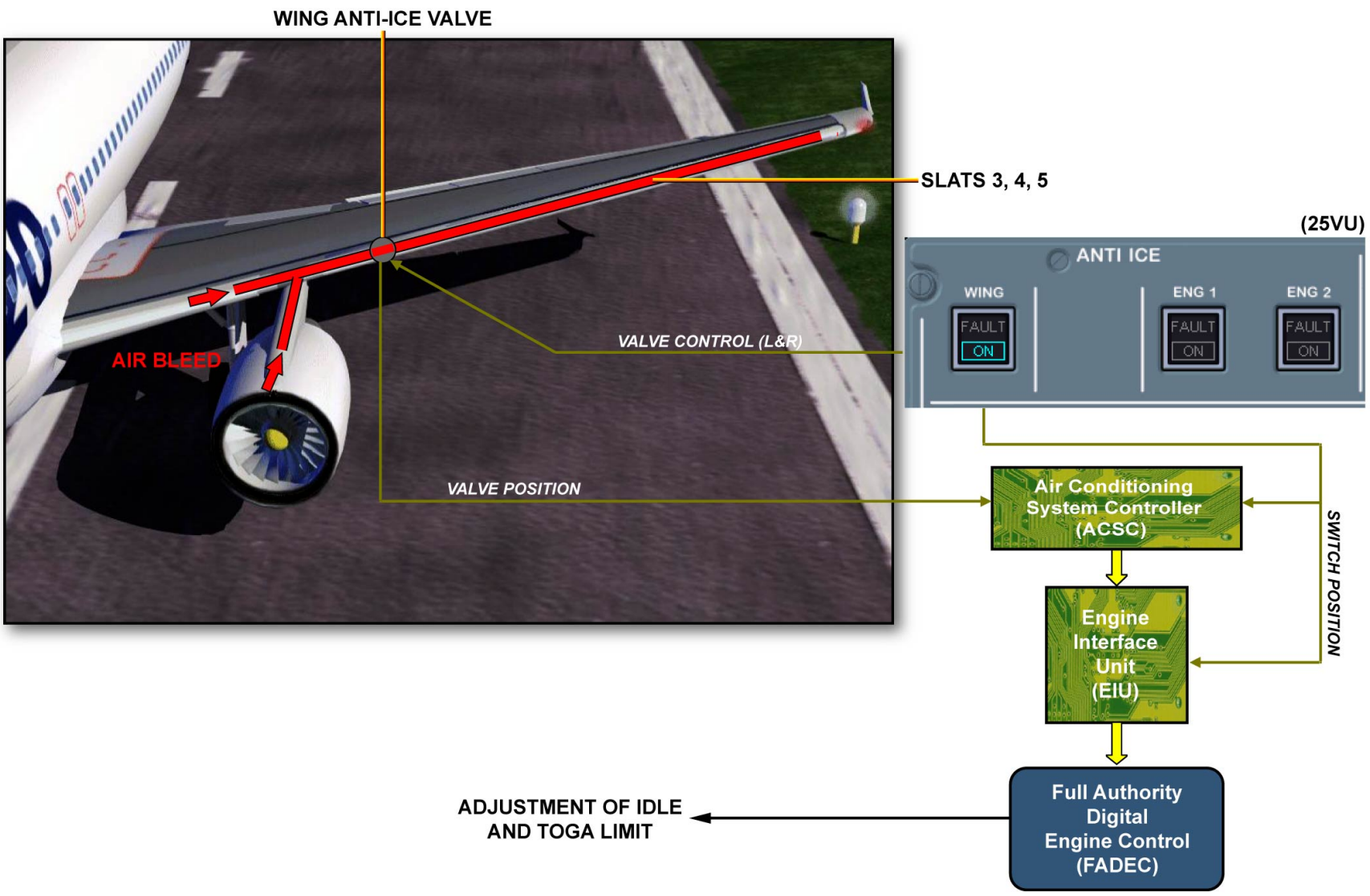
SYSTEM INTRODUCTION

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

WING ICE PROTECTION

Only one P/BSW on the overhead ANTI ICE panel controls WAI supply to the two wings. WAI must be manually selected by the crew and is available in flight only. For testing functions, the WAI can be selected on the ground but will be automatically limited to 30 seconds operation to prevent damage to the wing leading edge.
When WAI is selected, the engine idle is increased and the Takeoff/Go Around (TOGA) limit (max thrust) is decreased by the Full Authority Digital Engine Control (FADEC). This signal is sent to the FADEC through the Engine Interface Unit (EIU).
Hot air from the pneumatic system is supplied for the anti-icing of the three outboard leading edge slats (3, 4 and 5) of each wing. Bleed air from the engines or the APU is supplied to each wing through a pressure regulating and shut off valve called Wing Anti-Ice (WAI) valve.

UGB13131 - U2AT4M0 - UM30PZ00000002



WING ICE PROTECTION

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

ENGINE AIR INTAKE ICE PROTECTION

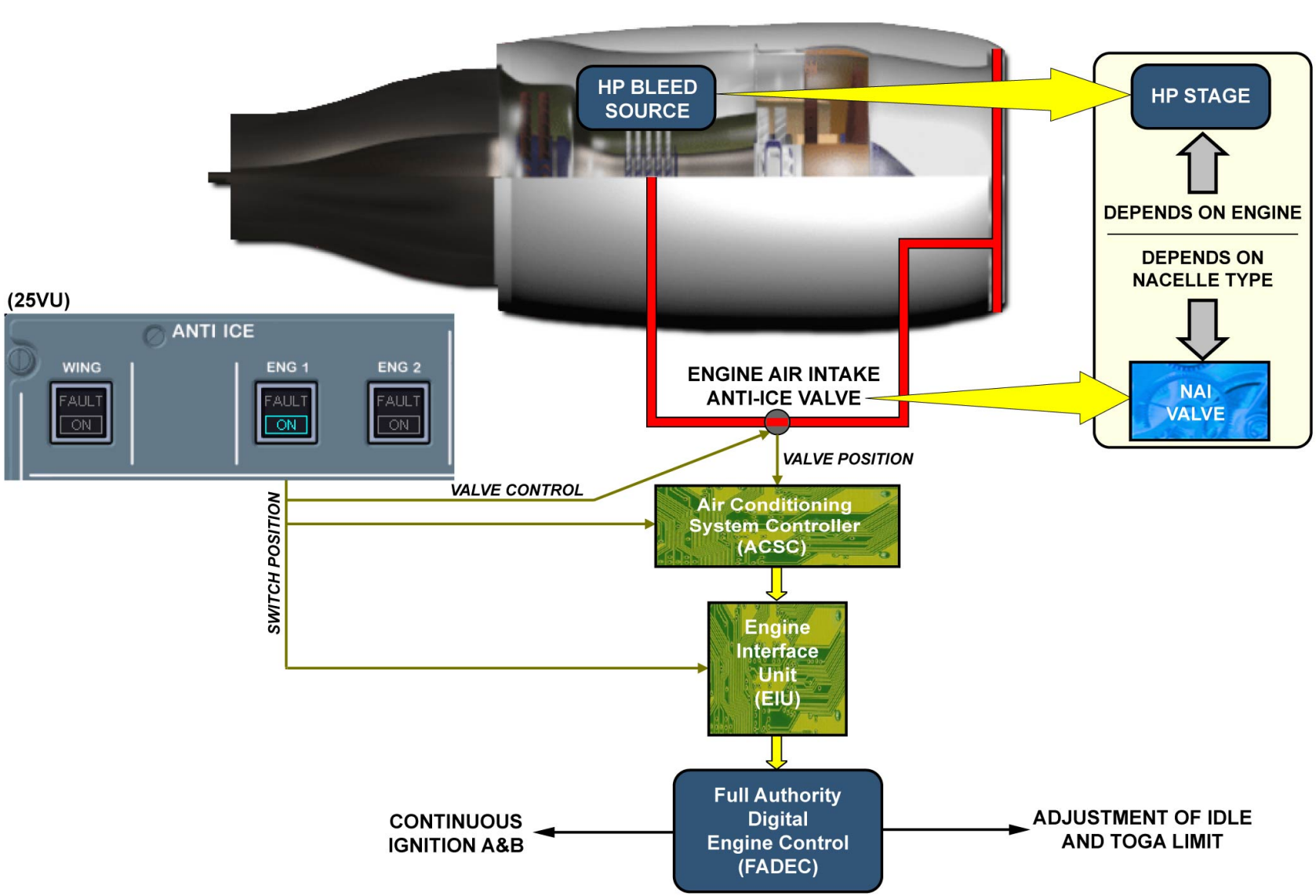
Engine anti-ice is manually selected by the crew and is available in flight or on the ground with the engine in operation. After its circulation around the inlet, the air is sent overboard.

NOTE: Note: If there is an electrical power supply failure, this valve will automatically open when the engine operates.

When engine anti-ice is selected, the engine idle speed is increased and the TOGA limit (max thrust) is decreased by the FADEC. This signal is sent to the FADEC through the EIU. The ignition system is automatically set to on for the PW6000 and V2500 engines. This is not applicable to the CFM engine.

Each engine air intake is protected from ice by an independent air bleed supply from the High Pressure (HP) compressor of that engine.

The air is supplied through the engine air intake anti-ice valve.



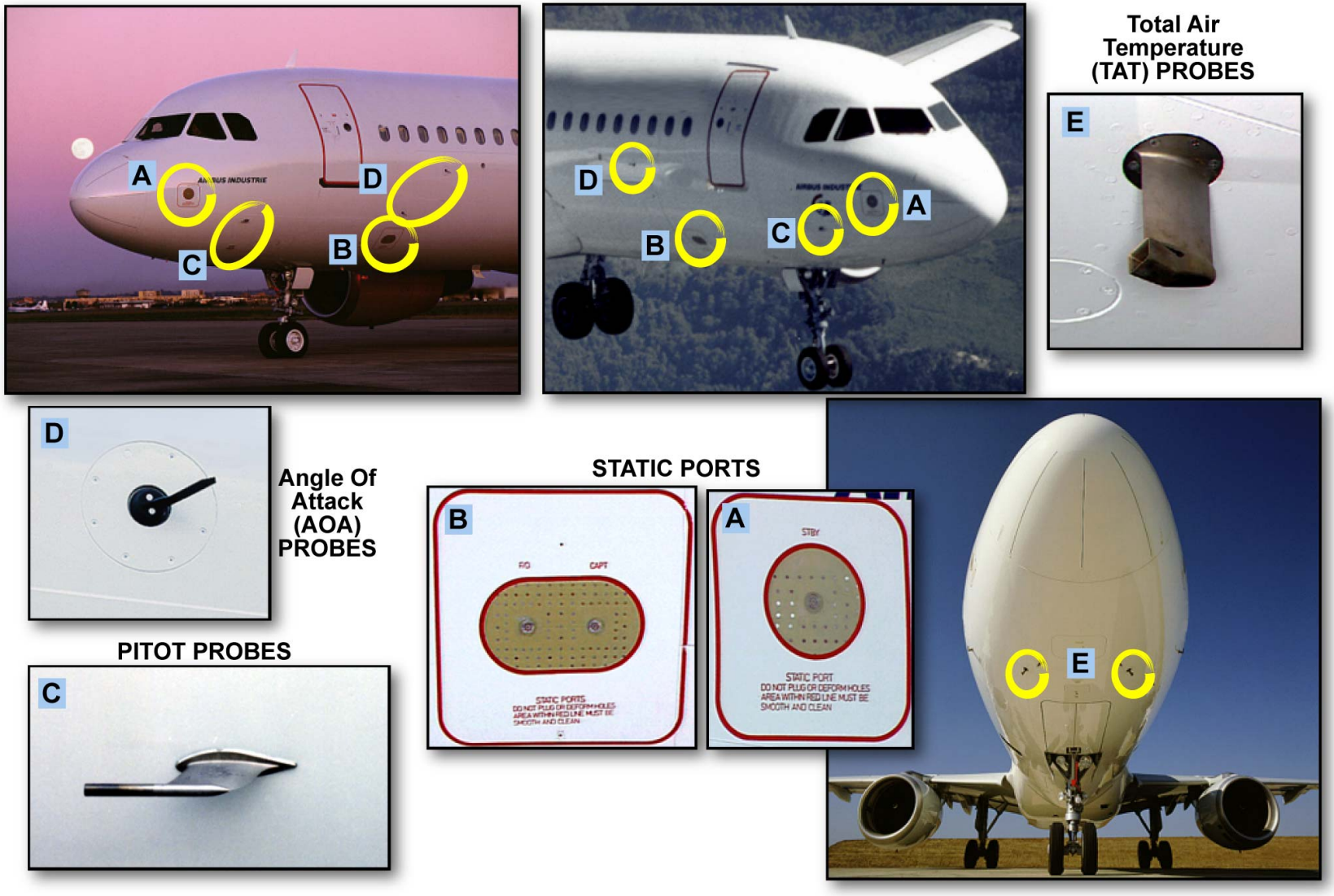
ENGINE AIR INTAKE ICE PROTECTION

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

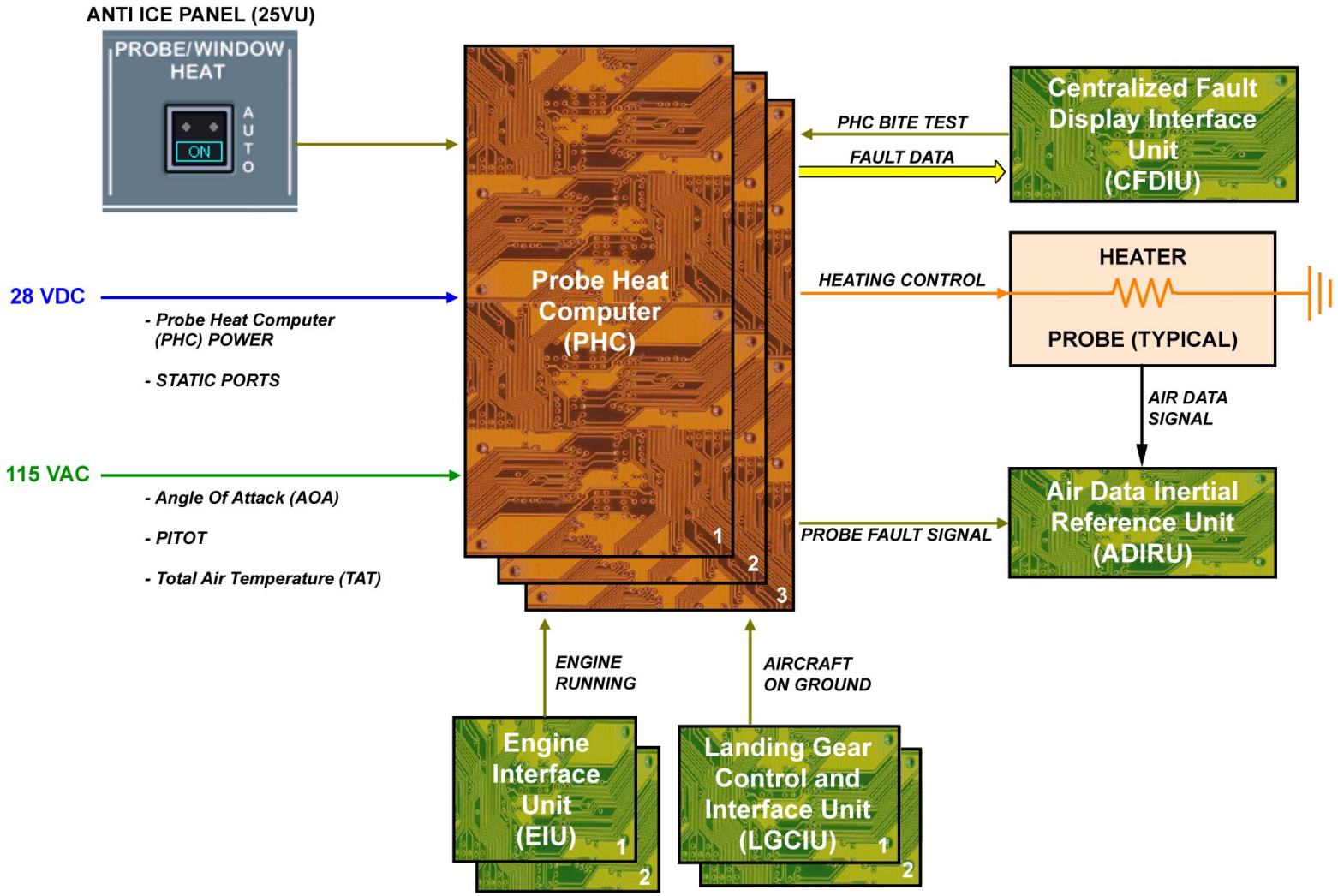
PROBE ICE PROTECTION

Ice protection of the Angle Of Attack (AOA) sensors, pitot probes, static ports and Total Air Temperature (TAT) probes is done by electrical heating.
In order to give reliable information to the air data systems, the air data probes are heated automatically when at least one engine is in operation.
The probes are arranged in three channels related to the three air data systems: CAPT, F/O and STBY (Air Data/Inertial Reference Unit (ADIRU) 1, 2, 3). The heating system for each channel is controlled by a Probe Heat Computer (PHC) 1, 2, 3.
The PROBE/WINDOW HEAT P/BSW (normally in the AUTO position) can be used to select the probe heating ON with the engines stopped.

UGB13131 - U2AT4M0 - UM30PZ00000002



PROBE ICE PROTECTION



PROBE ICE PROTECTION

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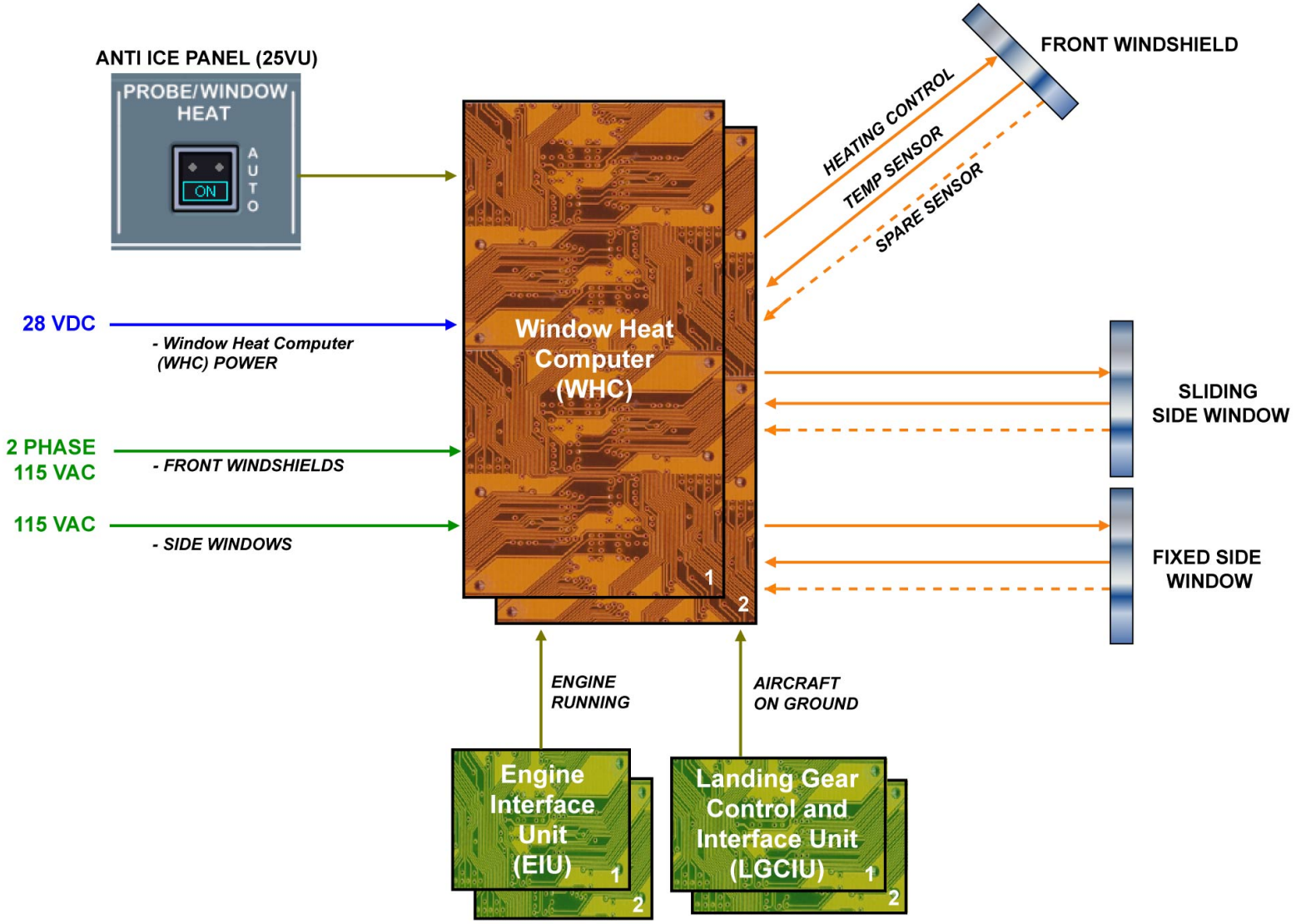
30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

WINDOWS ANTI-ICING AND DEFOGGING

Electrical heating is supplied for windshield anti-icing and cockpit side window de-fogging.
The front windshields and side windows are heated automatically when at least one engine is in operation. The heating system for each side is controlled and monitored by a Window Heat Computer (WHC) 1, 2.
The PROBE/WINDOW HEAT P/BSW (normally in the AUTO position) can be used to select the window heating ON with the engines stopped.
The windows are protected against overheat by sensors and flight/ground logic. The sensors turn off the heat when the temperature reaches the limit and the windows are heated at a lower power on the ground than in flight.

WINDOWS ANTI-ICING AND DEFOGGING



WINDOWS ANTI-ICING AND DEFOGGING

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30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

WINDSHIELD RAIN SYSTEM PRESENTATION

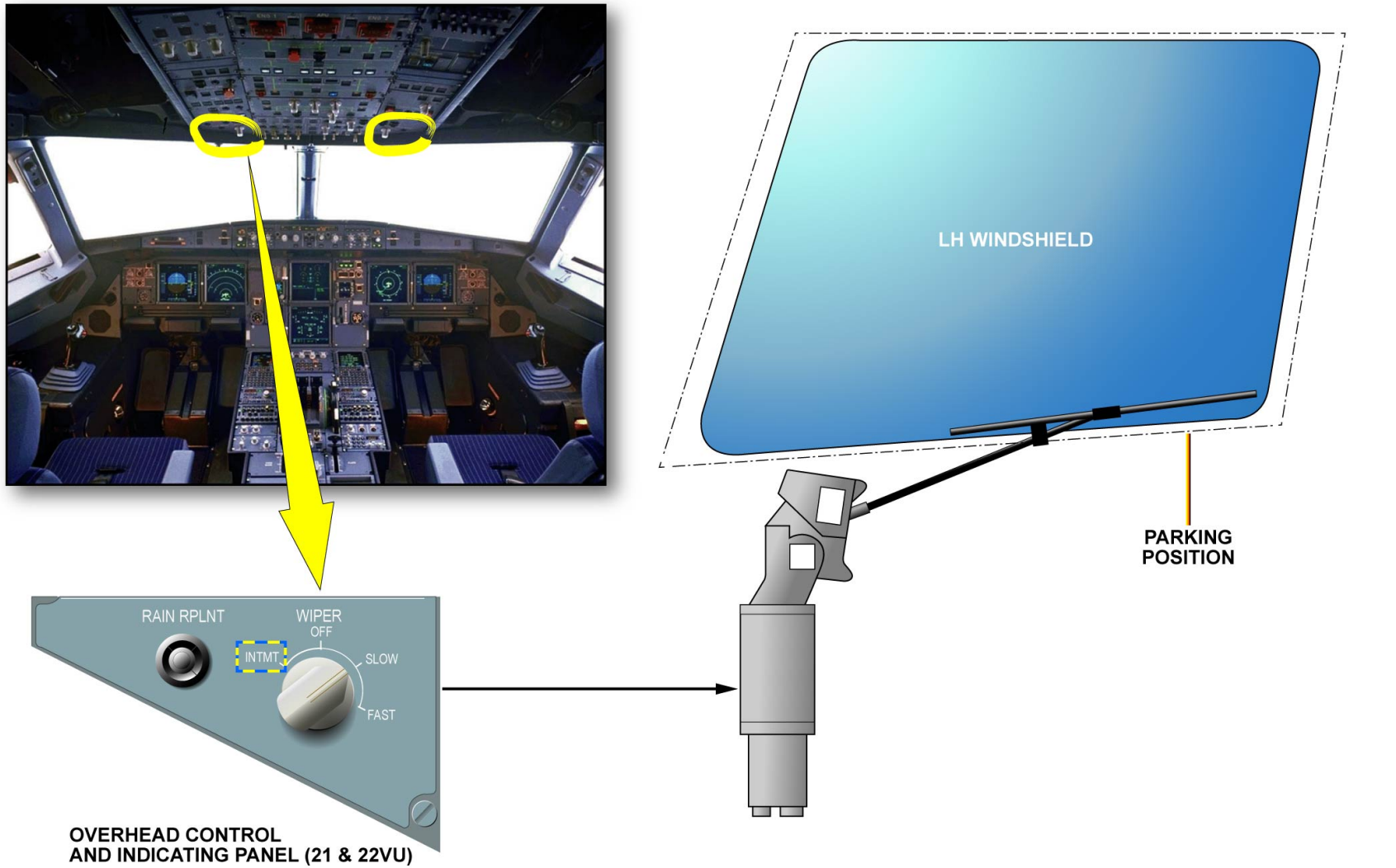
Rain removal from the right and left windshields is done by two systems:
- Wiper system,
- Rain repellent fluid system.

The wiper system will be used satisfactorily at an aircraft speed of 230 knots or less. The rain repellent system is used to have better visibility through the windshield in heavy rain, particularly when the wipers are not satisfactory.

WIPER SYSTEM PRESENTATION

Two wipers, one for each windshield, are energized independently by DC motors to remove rain from the windshields.
On the overhead panel, a rotary selector controls each wiper. "SLOW" or "FAST" speed can be selected. The selector switch can optionally have an "INTerMiTtent" position. When the selector is set to "OFF", the wiper stops in the parking position. The parking position is at the bottom and away from the windshield. This gives a clear visibility area and prevents dust/sand accumulation which can cause scratches on the windshields.

NOTE: Do not operate the wipers on a dry windshield.



WINDSHIELD RAIN SYSTEM PRESENTATION - WIPER SYSTEM PRESENTATION

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

RAIN REPELLENT FLUID SYSTEM

The rain repellent system uses the rain repellent fluid stored in a pressurized canister installed in the aft left wall of the cockpit.
The rain repellent fluid can be discharged individually on the left/right windshield, from its related "RAIN RePeLeNT" pushbutton switch on the overhead panel, adjacent to the wiper selector.

UGB13131 - U2AT4M0 - UM30PZ00000002

RAIN REPELLENT CANISTER

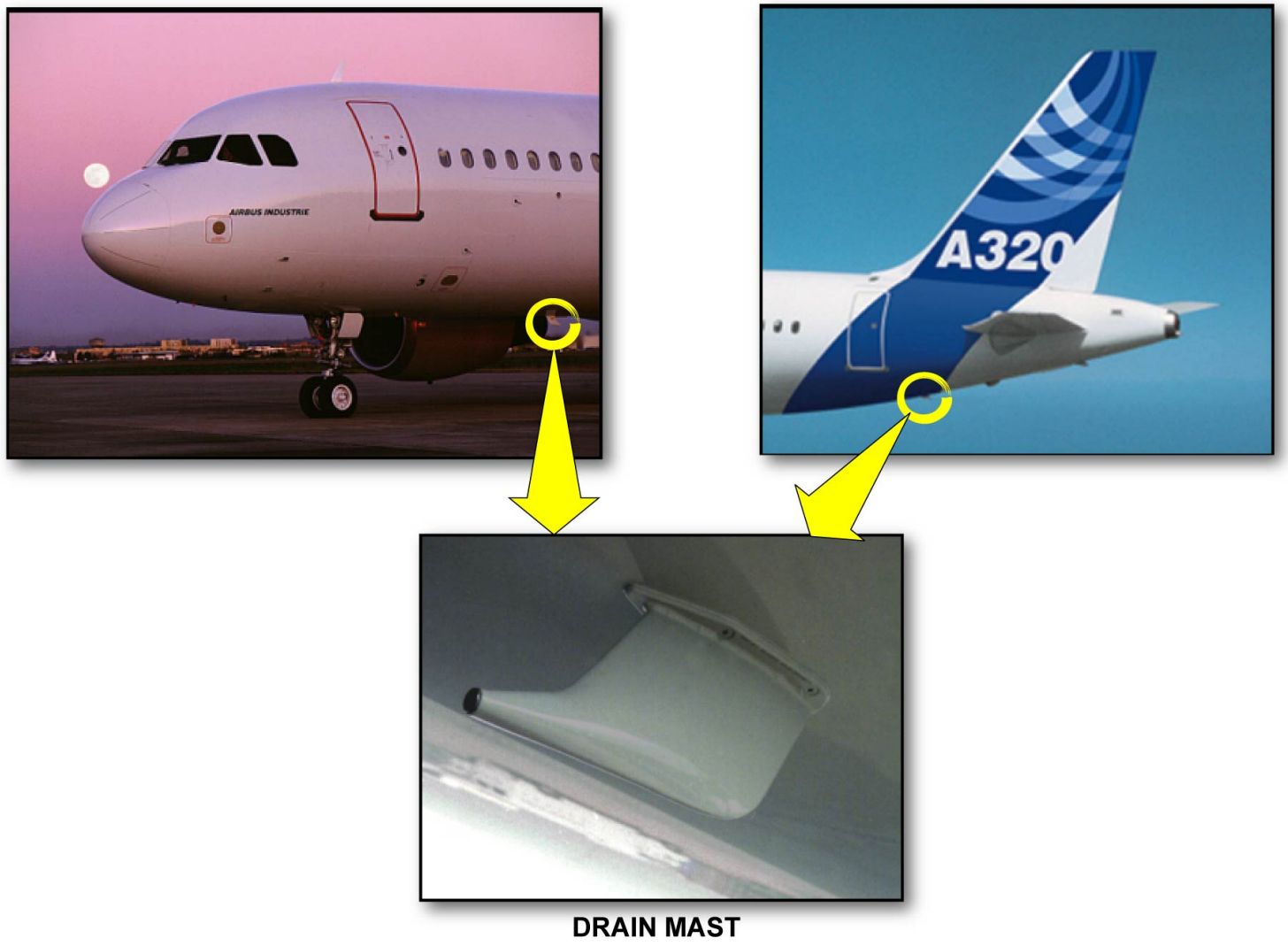
RAIN REPELLENT FLUID SYSTEM

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

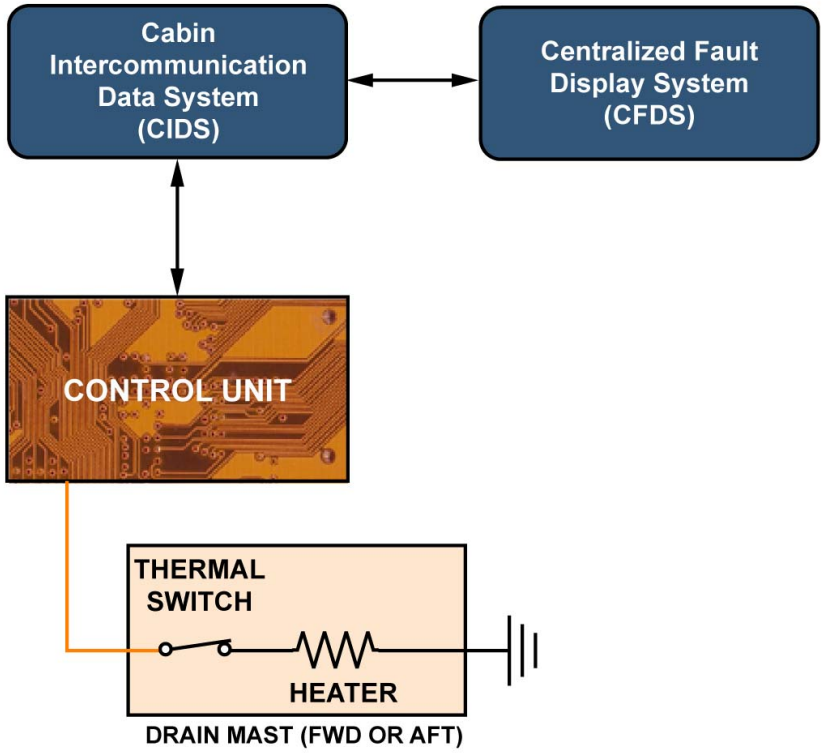
DRAIN MAST ICE PROTECTION

There are two drain masts installed on the lower fuselage forward and aft sections.
When the electrical system is energized, the waste water drain masts are also electrically heated. Two control units control the heating of the forward and aft drain masts.

UGB13131 - U2AT4M0 - UM30PZ00000002



DRAIN MAST ICE PROTECTION



DRAIN MAST ICE PROTECTION

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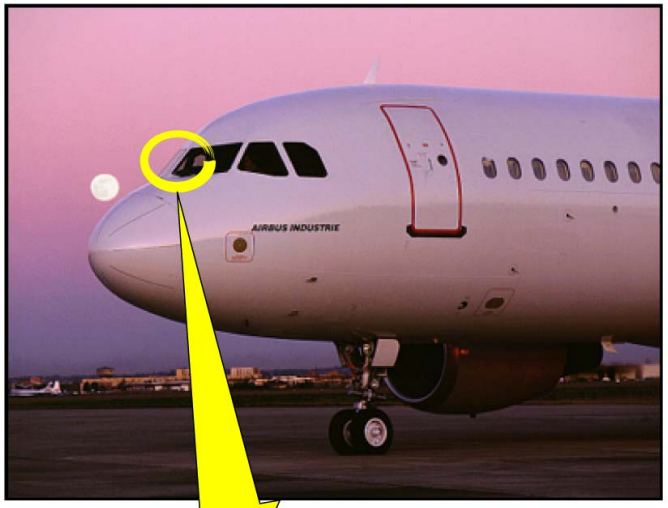
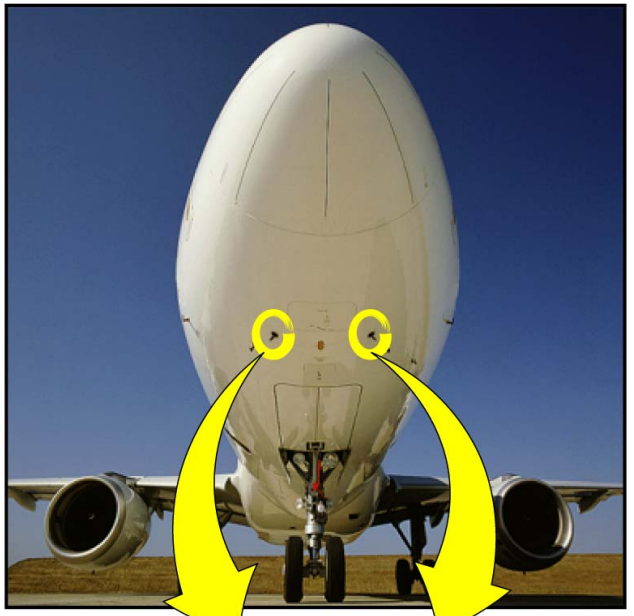
30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

ICE DETECTION

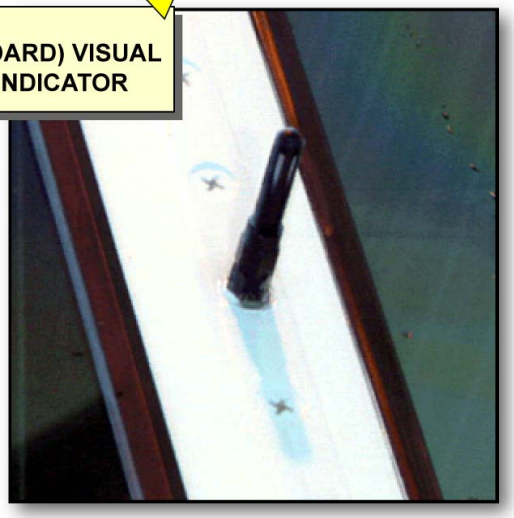
An external visual ice indicator with an integral light is installed between the two windshields.
The ice detection system (if installed) has two separate ice detectors on the forward lower section of the fuselage. The ice detectors send an "ice detected" signal directly to the Flight Warning Computers (FWCs).

UGB13131 - U2AT4M0 - UM30PZ00000002

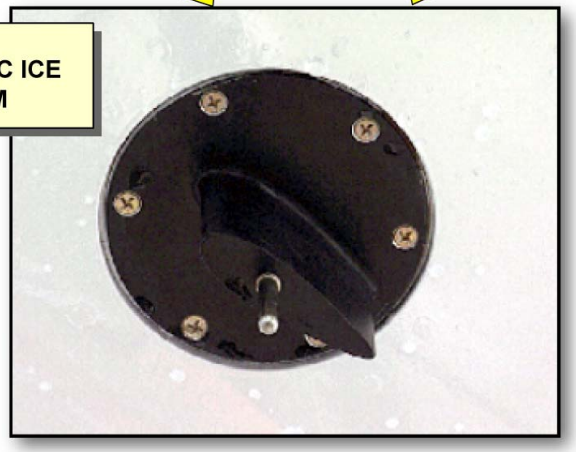




(STANDARD) VISUAL ICE INDICATOR



(OPTIONAL) ELECTRONIC ICE DETECTION SYSTEM



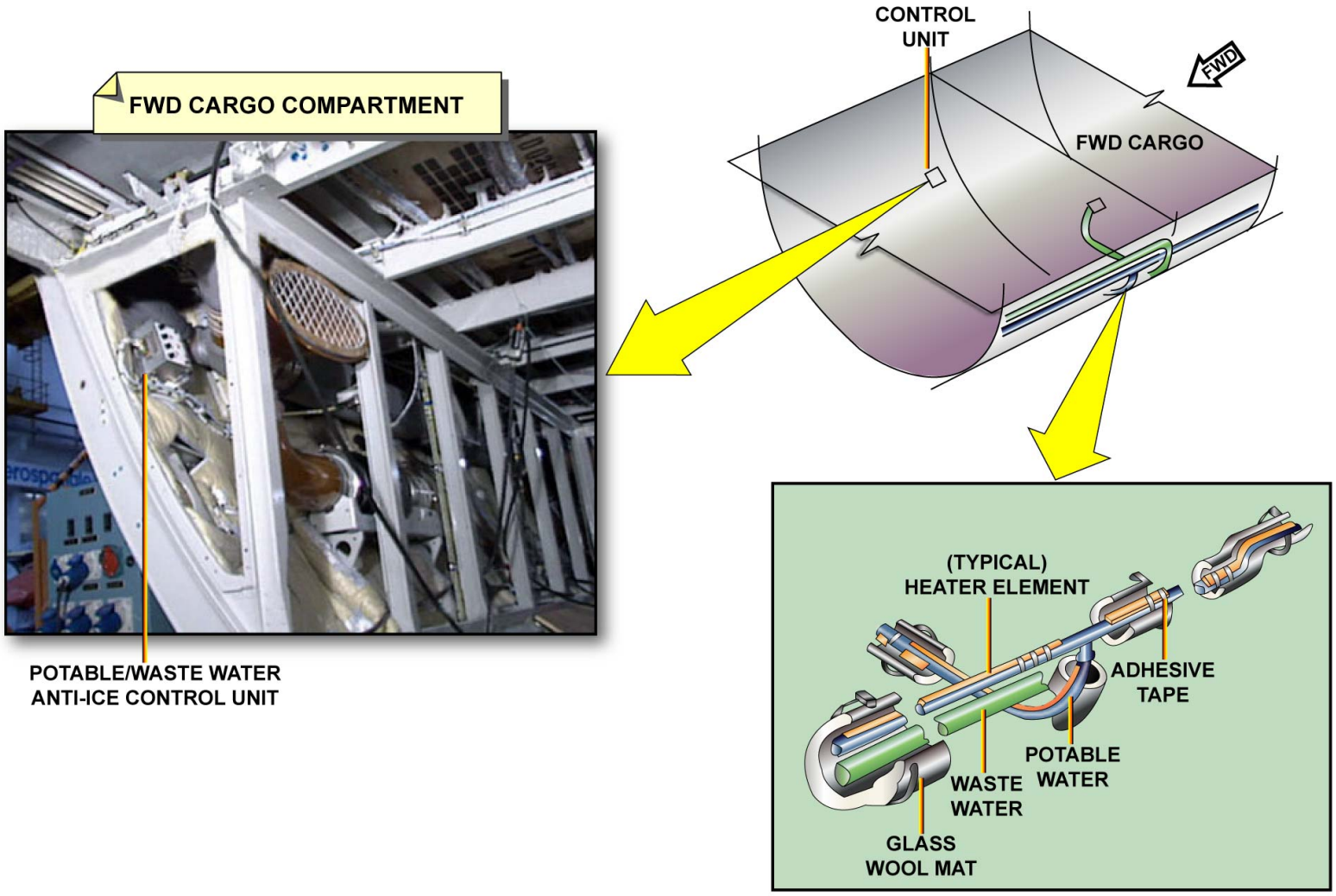
ICE DETECTION

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

MISCELLANEOUS SYSTEMS

The aircraft can also have electrical heating systems for:
- Potable water supply lines,
- Waste water lines,
- Water servicing panels.

Control units are connected to temperature sensors and automatically control these heating systems. The control units control multiple heating elements.


FWD CARGO COMPARTMENT
POTABLE/WASTE WATER
ANTI-ICE CONTROL UNIT
CONTROL
UNIT
FWD
FWD CARGO
(TYPICAL)
HEATER ELEMENT
ADHESIVE
TAPE
POTABLE
WATER
WASTE
WATER
GLASS
WOOL MAT

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

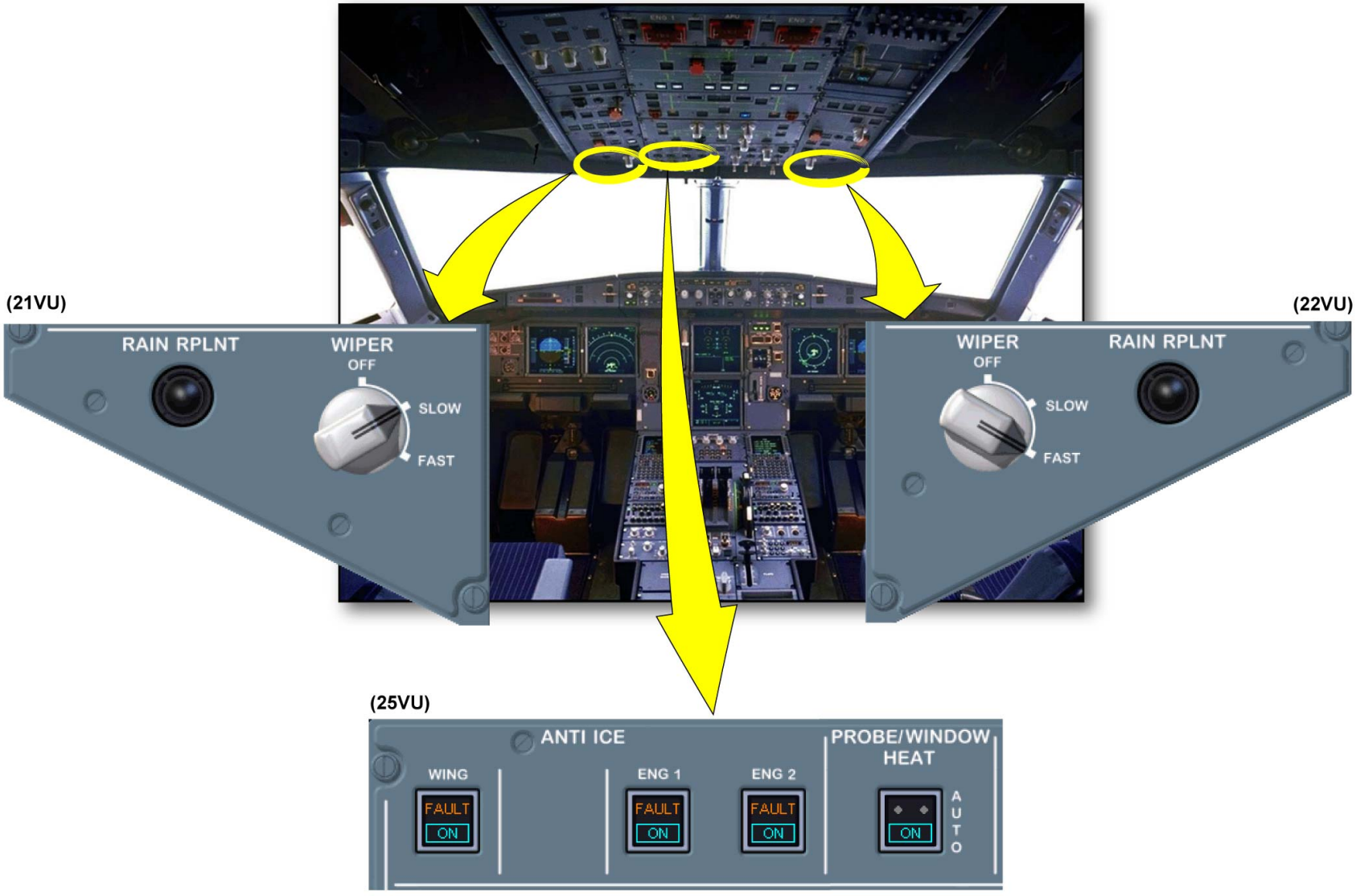
CONTROL AND INDICATING

This section is related to the control panels and indications for the ice and rain protection systems.

CONTROL PANEL

The controls for the engine and wing anti-ice systems are operated from the overhead ANTI ICE panel. The probes ice protection and windows anti-icing systems are controlled from the PROBE/WINDOW HEAT P/BSW.
Each rain removal system is independently controlled by individual selectors on the overhead panel.

UGB13131 - U2AT4M0 - UM30PZ00000002



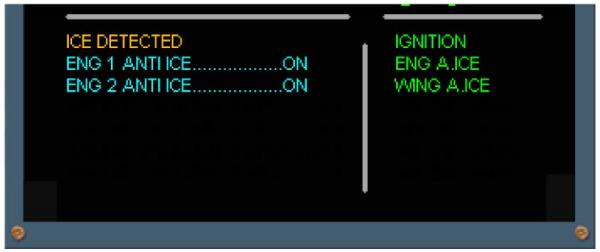
CONTROL AND INDICATING - CONTROL PANEL

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

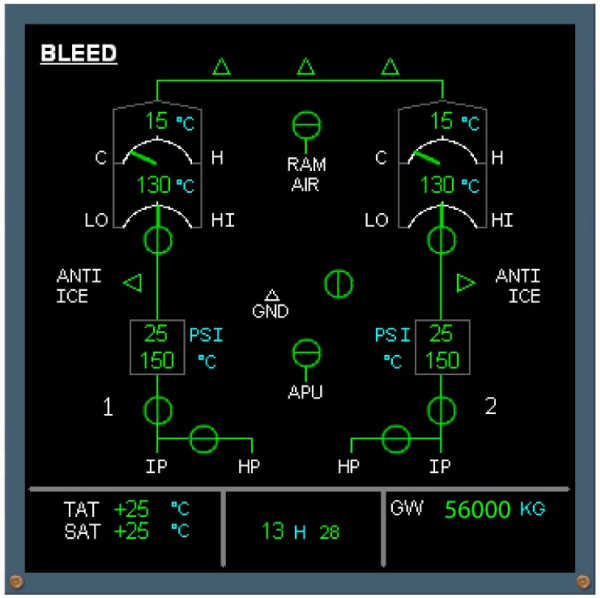
CONTROL AND INDICATING (continued)

ECAM INDICATION

A MEMO is displayed on the upper ECAM when engine anti-ice or WAI is selected. WAI valve position indication is available on the BLEED page when the system is selected.
The optional electronic ice detection system sends warnings directly to the ECAM through the FWCs. The warning messages are displayed on the E/WD.



E/WD



SYSTEM DISPLAY (SD)

CONTROL AND INDICATING - ECAM INDICATION

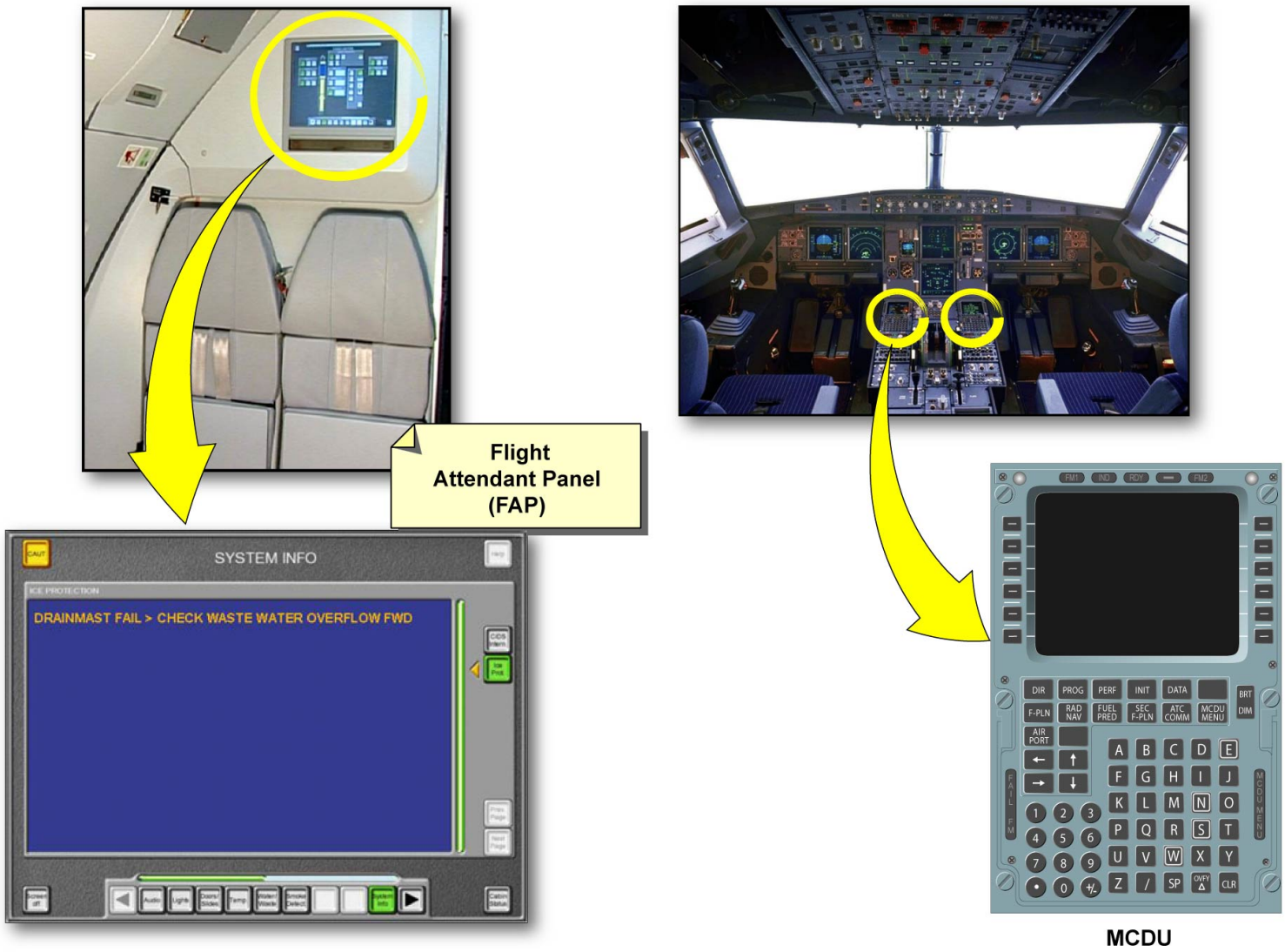
30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

CONTROL AND INDICATING (continued)

DRAIN MAST MONITORING

Drain mast heating faults can be displayed on the Flight Attendant Panel (FAP) or on the MCDU via the CFDS.

UGB13131 - U2AT4M0 - UM30PZ00000002

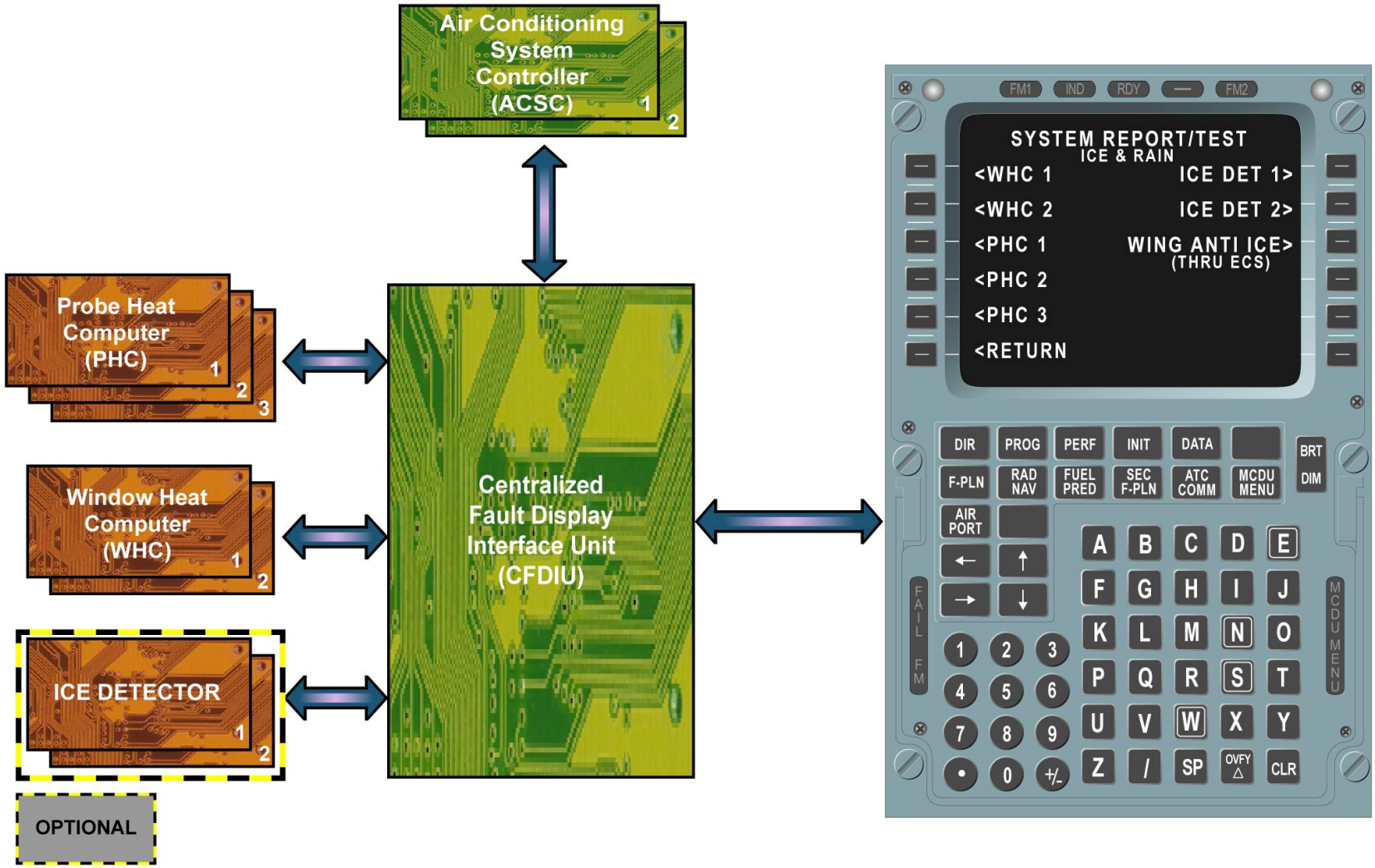


CONTROL AND INDICATING - DRAIN MAST MONITORING

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

MAINTENANCE/TEST FACILITIES

The Air Conditioning System Controller (ACSC) monitors the wing and engine anti-ice valve position and the valves P/BSW position. The ACSC transmits this data to the Centralized Fault Display System (CFDS). All 3 PHCs, the two WHCs and the ice detectors are connected directly to the Centralized Fault Display Interface Unit (CFDIU). Each system menu is available through the MCDU.



MAINTENANCE/TEST FACILITIES

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

SAFETY PRECAUTIONS

When you do work on the ice and rain protection system, make sure that you obey all Aircraft Manual Maintenance (AMM) safety procedures. This will prevent injury to persons and/or damage to the aircraft. Here is an overview of the main safety precautions related to the ice and rain protection system.

Remove the protective covers from the probes before you activate the probe ice protection system.

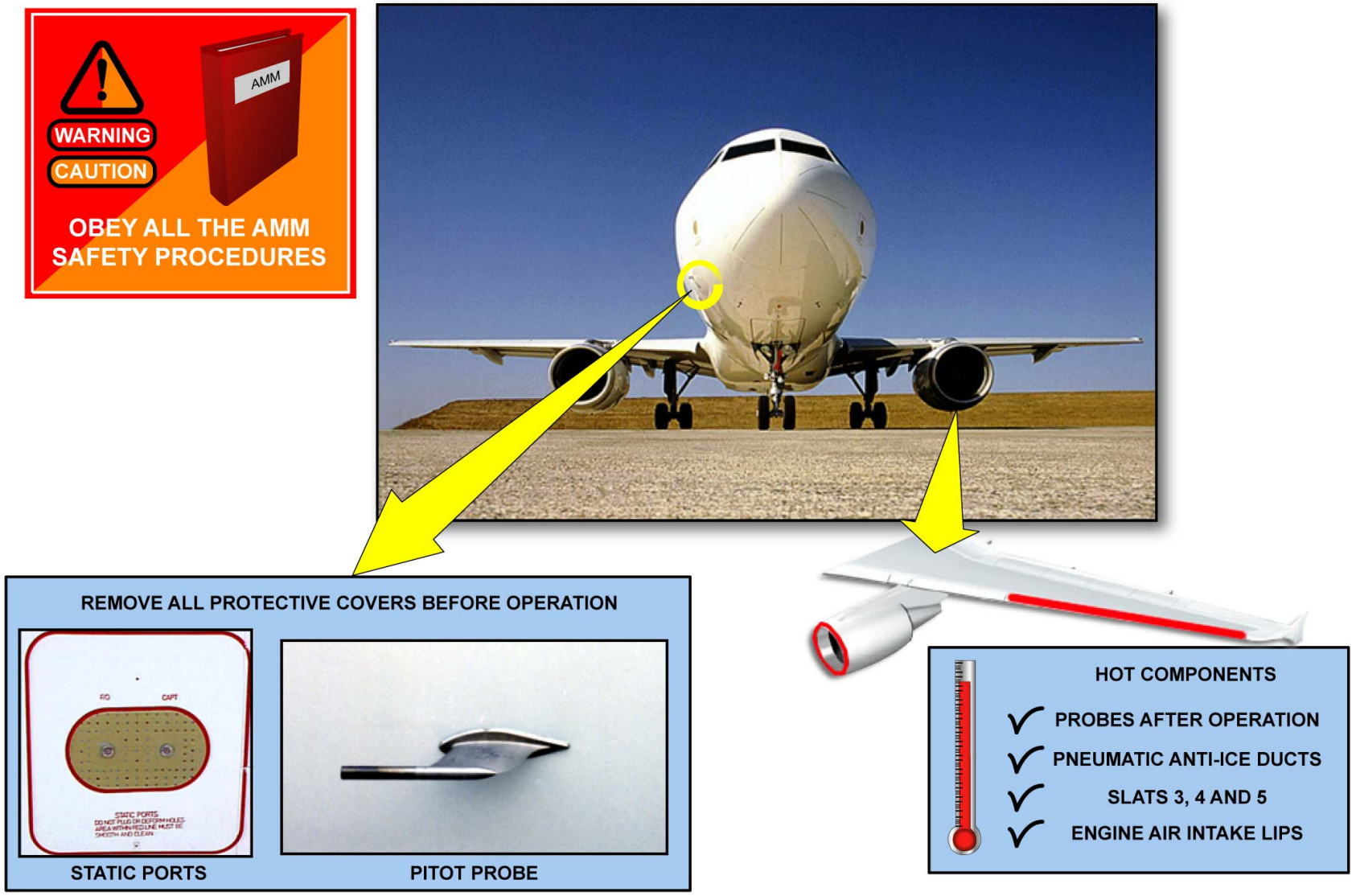
If possible, remove the protective covers before electrical power is applied to the aircraft, in case of a system malfunction.

Do not touch the probes during or immediately after operation. The probes are hot and can burn you.

Do not touch the anti-ice ducts, slats 3, 4 and 5 and engine air intake lips until they are cool.

These items stay hot for some time after the engine stops.

UGB13131 - U2AT4M0 - UM30PZ00000002



SAFETY PRECAUTIONS

30 ICE AND RAIN PROT SYSTEMS PRESENTATION (1)

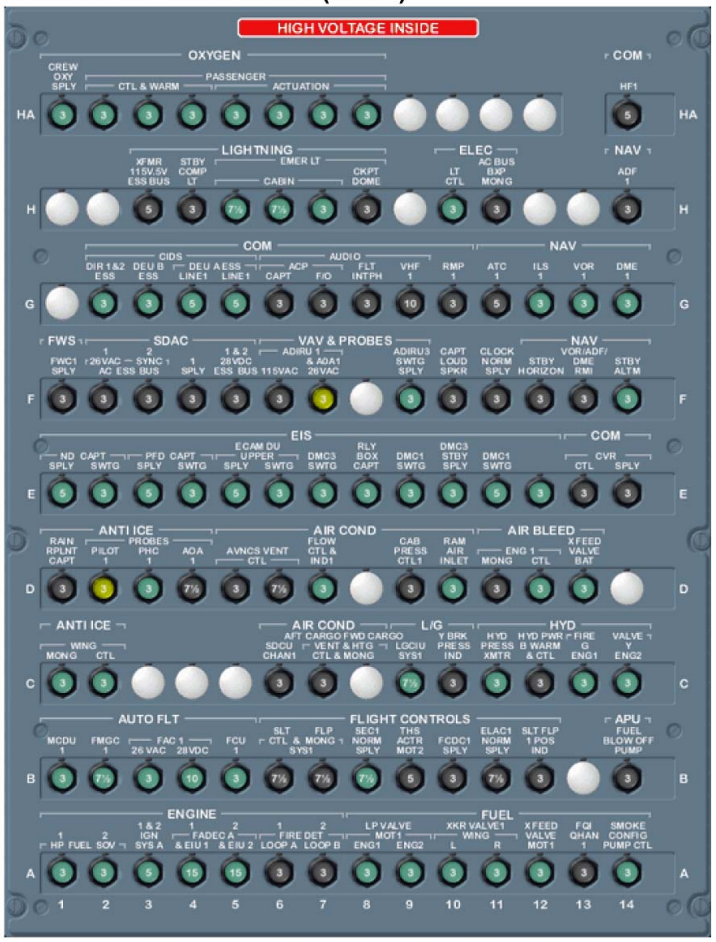
SAFETY PRECAUTIONS (continued)

WARNINGS ABOUT FAIL SAFE HEATING

The probe heat system is a fail-safe system used to keep the probes and static ports de-iced (in flight) if a PHC failure occurs.
The window heat system is designed to keep the windows defogged (in flight) if a WHC failure occurs.
If the PHC or WHC power Circuit Breakers (C/Bs) are pulled, the probe or window heat will come on. This will also occur if the EIU C/B is pulled. The EIU controls the "engine running" signal for automatic operation. If one of these C/Bs is pulled, all of the heater C/Bs must also be pulled.

UGB13131 - U2AT4M0 - UM30PZ00000002

OVERHEAD C/B PANEL (49VU)



WARNING

PULLING THE PROBE HEAT COMPUTER (PHC), THE LANDING GEAR CONTROL AND INTERFACE UNIT (LGCIU) OR THE ENGINE INTERFACE UNIT (EIU) POWER SUPPLY CIRCUIT BREAKERS CAUSES UNWANTED HEATING OF THE PROBES & STATIC PORTS AND / OR THE WINDOWS.
THIS CAN CAUSE INJURY AND BURNS.

SAFETY PRECAUTIONS - WARNINGS ABOUT FAIL SAFE HEATING

05 TIME LIMITS AND MAINTENANCE CHECKS (1)

SCHEDULED MAINTENANCE TASKS & CHECKS in MPD

This Chapter 05-20-00 "Life Limits and Maintenance Checks" is now covered in the Maintenance Planning Document (MPD).
The MPD is the repository document for all repetitive scheduled maintenance tasks declared by Airworthiness Directives (AD/CN), All Operator Telex (AOT), Inspection Service Bulletins (ISB), Service Information Letters (SIL), and Modifications (MOD/SB) and analyzed under the Maintenance Review Board (MRB).

UN-SCHEDULED MAINTENANCE in AMM Section 05-50-00

This Chapter 05-50-00 includes the maintenance checks that you must do when a flight crew report shows abnormal flight conditions.
Such maintenance actions are divided into two categories of information:
- inspections,
- checks.

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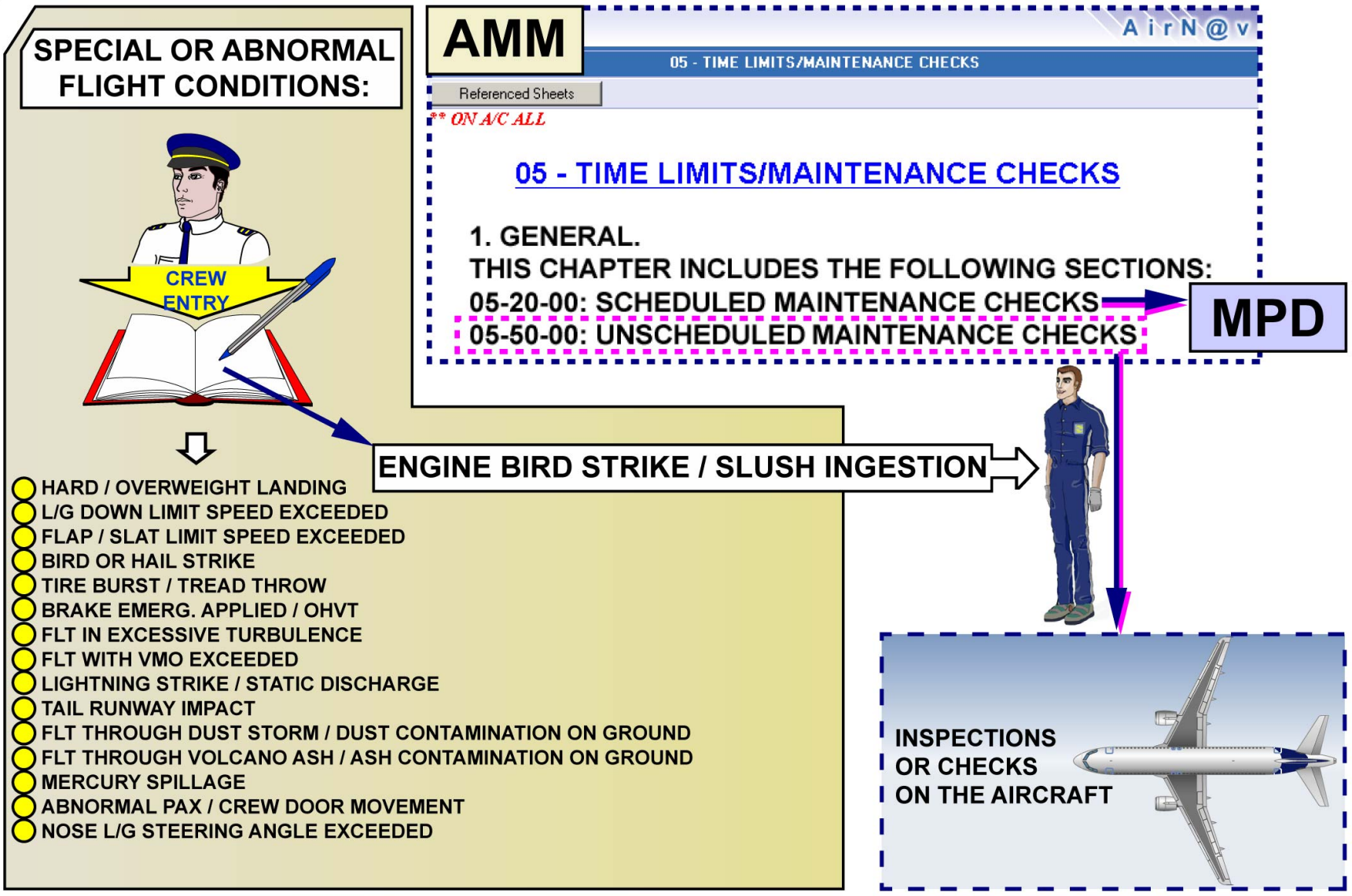
SPECIAL OR ABNORMAL FLIGHT CONDITIONS:
CREW ENTRY
HARD / OVERWEIGHT LANDING
L/G DOWN LIMIT SPEED EXCEEDED
FLAP / SLAT LIMIT SPEED EXCEEDED
BIRD OR HAIL STRIKE
TIRE BURST / TREAD THROW
BRAKE EMERG. APPLIED / OHVT
FLT IN EXCESSIVE TURBULENCE
FLT WITH VMO EXCEEDED
LIGHTNING STRIKE / STATIC DISCHARGE
TAIL RUNWAY IMPACT
FLT THROUGH DUST STORM / DUST CONTAMINATION ON GROUND
FLT THROUGH VOLCANO ASH / ASH CONTAMINATION ON GROUND
MERCURY SPILLAGE
ABNORMAL PAX / CREW DOOR MOVEMENT
NOSE L/G STEERING ANGLE EXCEEDED
ENGINE BIRD STRIKE / SLUSH INGESTION
AMM
AirN@v
05 - TIME LIMITS/MAINTENANCE CHECKS
Referenced Sheets
** ON A/C ALL
05 - TIME LIMITS/MAINTENANCE CHECKS
1. GENERAL.
THIS CHAPTER INCLUDES THE FOLLOWING SECTIONS:
05-20-00: SCHEDULED MAINTENANCE CHECKS
05-50-00: UNSCHEDULED MAINTENANCE CHECKS
MPD
INSPECTIONS OR CHECKS ON THE AIRCRAFT

SCHEDULED MAINTENANCE TASKS & CHECKS IN MPD & UN-SCHEDULED MAINTENANCE IN AMM SECTION 05-50-00

05 TIME LIMITS AND MAINTENANCE CHECKS (1)

SCHEDULED REPETITIVE REQUIREMENTS THROUGH MPD

The main objective of the MPD document is to provide maintenance planning information necessary for each operator to develop a customized maintenance program.
MPD reflects all repetitive scheduled maintenance tasks declared by AD/CN, AOT, ISB, SIL, and MOD/SB and analyzed under the MRB.
A typical scheduled repetitive task (Integrated Drive Generator (IDG) scavenge filter) is listed with the following data:
- the threshold interval, source document, cross-references to other manuals or documents (Aircraft Maintenance Manual (AMM) and SIL),
- Man Hours required to accomplish the work,
- the applicability in this Envelope document.

Note the Zonal inspection, requested by C CHECK interval, on the tension of the fan cowl latches, the AOT, AMM and SIL cross-referenced.
Some maintenance tasks have a higher ranking of requirement, when the maintenance requirement is identified as:
- "Airworthiness Limitations Item" (ALI) or "Life limit parts",
- "Certification Maintenance Requirements" (CMR).

The approved document MRB REPORT Appendix 1 lists all these airworthiness approved issues, the ALIs and CMRs.
The MPD details these airworthiness related items in the "Time controlled Items" and "Life Limits" sections.
It is the responsibility of each operator to adjust his own maintenance program in accordance with his National Authority.

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A318/A319/A320/A321 MAINTENANCE PLANNING DOCUMENT

TASK NUMBER	ZONE	DESCRIPTION	THRESHOLD INTERVAL	SOURCE	REFERENCE	MEN	M/H	APPLICABILITY
242100-03-1	438 448	INTEGRATED DRIVE GENERATOR AF DS -REMOVE AND DISCARD SCAVENGE FILTER ELEMENT -DRAIN AND REPLENISH OIL SYSTEM NOTE : - REPLACE FILTER ELEMENT, DRAIN IDG OIL AND REPLENISH AT 150FH AFTER AIRCRAFT DELIVERY. THEREAFTER REFER TO INTERVAL. - INTERVAL MAY BE ADJUSTED IN ACCORDANCE WITH SIL SUN 236.	I: 800 FH OR NOTE	MRB 6	242100-820-040 AMM 242100/3 SIL 24-049 SIL SUN 236 CMP A17EA 4000	1 1	0.40 0.40	CFM

A320 MRB Report Appendix 1

REFERENCE 20.00/06

AMM

SIL

SYSTEMS PROGRAM

POWER PLANT PROGRAM

STRUCTURE PROGRAM

MPD

AUTHORITY REVIEW MANDATORY

ALI (Airworthiness Limitation Items)
CMR (Certification Maint. Requirements)

ZONAL VISUAL INSPECTIONS

TIME CONTROLLED ITEMS

LIFE LIMITS

OPERATOR MUST ADJUST ITS OWN MAINTENANCE PROGRAM

MOST APPROPRIATE USAGE PARAMETER
FLIGHT HOURS, CALENDAR TIME, CYCLES
AS DEFINED PER LATEST MPD REVISION

ON THE AIRCRAFT

LATCH
AMM 711300/5
SIL 71-033
AOT 71-A1024

BATTERY RESTOR.

EXTINGU. BOTTLE PRESS SWITCH

GEARS

SCHEDULED REPETITIVE REQUIREMENTS THROUGH MPD

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